A HOUSING INFORMATION SERVICE

A SYSTEMATIC APPROACH TOWARDS THE EFFECTIVE USE OF STRUCTURED BUILDING APPRAISALS IN THE DESIGN OF NEW HOUSING

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1987

DECLARATION

This thesis has been composed by myself and is my own original work.

ACKNOWLEDGMENTS

This thesis is dedicated to my parents, the late Mr. Hong Boum Yoon and Mrs. Myung Sook Lee, and the rest of my family for their unsparing encouragement and support.

Many people in various countries have contributed to the realisation of this thesis by generously offering their invaluable expertise. Above all, I would like to express my gratitude to Dr. P. F. Crofts and Mr. R. D. Talbot for their valuable supervision and criticism throughout the study. Special thanks are due to Dr. Crofts, without whose enduring encouragement and kindness the study could not have been completed, and to his wife, Mrs. Dodie Crofts, for her warm hospitality.

ABSTRACT

This study is concerned with the search for workable improvements in the design of housing schemes by means of feedback obtained through the appraisal and measurement of performance of existing housing schemes.

Feedback information is seldom fully utilised by designers. This is due on the one hand, to the scattered and disorganised nature of feedback information sources and on the other, to the general lack of exchange of experience and information between designers. Valuable experience gained from past projects is thereby often wasted, resulting in the tendency to repeat mistakes and to overlook the existence of proven solutions.

There is then, a serious need for access to sources of relevant information, enabling us to find simply and precisely what we want without continual reference to colleagues or written sources. This can only be achieved where there is a provision for the structuring of feedback information, ensuring its easy retrieval and in a form that can be readily used.

To this end, this thesis proposes a computerised housing information service which will process feedback information derived from the analysis and appraisal of existing housing schemes. Furthermore, this thesis explores whether the establishment of such a housing information service on a national scale would be both a desirable and viable proposition.

Discussion of the conceptual and technical specifications for the proposed service is followed by the description of a small pilot demonstration system, developed to appraise potential user acceptance. The results of a series of system demonstrations are analysed.

PREFACE

The motivation for this study is prompted by my strongly held belief that significant improvements in the overall quality of housing, both in the general context, and with particular reference to Korea, may be achieved through a better informed design process. Following an architectural training in Korea and the USA, together with a period of practical design experience in Korea, I wanted to be able to back up this belief by thoroughly exploring the background to the problem, and by putting forward specific proposals for its remedy. This has been made possible by the undertaking of this thesis at Edinburgh, in a country which has a strong reputation in the field of design research.

The process of shaping a particular thesis topic, and the setting of realistic boundaries to its overall scope, were considerably aided by many discussions with Dr. P. F. Crofts and Mr. R. D. Talbot, to whom I owe grateful thanks.

From the outset it was felt important, not only to make a number of practical proposals, but also to be able to test them against the theoretical and practical considerations of practising designers. Therefore, I would also like to thank the various people who participated in the series of demonstrations described at the end of the thesis.

Finally, as suggested above, this thesis is not intended to finish up on the shelf. I feel strongly that the proposals contained herein should be carefully studied by those institutions, mentioned in Chapter Ten, concerned with the practice and profession of housing design. In particular, it is to be hoped that the relevant arm of the Government of Korea will view these proposals favourably, in view of its wide scale and continuing programme in support of both public and private housing developments throughout the country, and its consequent intense involvement with the practice of housing design.

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1. PROBLEMS

Architectural design is distinguished from other design fields by the great number of decisions required to be taken before a design brief can be realised as a building product. Furthermore, changes in both society and technology render the scope and magnitude of architectural design increasingly complex. This in turn increases the quantity and diversity of design decisions which a designer has to make. Accordingly, the place of information in architectural design is gradually receiving greater attention and consideration by the profession, yet the amount of information used by designers throughout the design process is still inadequate when compared to the overall scale and complexity of today's design work. In general, designers show little enthusiasm for the search for information, preferring to design with only minimal amounts of information. Information activity only occurs when there are critical requirements placed on the designer involved. However important information may be for the quality of a project, a full commitment to information activity seldom occurs.

The general consensus amongst designers is that it invariably proves difficult to locate relevant information quickly and in a usable form. The difficulty varies in degree according to the type of information required. One of the most difficult is often said to be that on the performance of various design treatments embodied in existing and past building schemes. This type is often referred to as 'feedback' information, that is, the analysis and appraisal of past design work organised in such a way that it may be used in any future design work.

The need for feedback is prompted by analogical thought processes which are an integral part of thought as a whole. Designers are at any one time faced with a variety of possible actions and varying degrees of uncertainty about the possible consequences of each action. Much of this uncertainty may be significantly reduced by appropriate experience and knowledge. There is however, a limit to the experience and knowledge that a designer will have, thus providing only an imperfect simulation of reality and giving relatively inaccurate forecasts of what may occur. Design solutions or decisions derived therefrom may be far from optimal. Design decisions based on inadequate experience have often had catastrophic consequences. Even where designers are greatly experienced, initial predictions of the outcome of design decisions can be unreliable as knowledge and experience becomes obsolete and irrelevant. This prompts designers to look for external sources of appropriate 'analogical' feedback. However, such information is a scarce commodity and where it does exist, it has been obtained and converted into a usable form only at great expense in both time and money.

Appraisal of past projects is in fact one of the most important, yet most neglected parts of architectural practice. It is a powerful means of signalling designers to potential faults and of improving the performance of current projects. Ultimately, it can provide better value for building users and greater accountability for those responsible for its implementation. The role of the appraisal of buildings in use for future projects needs to be further recognised and emphasised. The improvement in the quality of the physical environment can only be achieved by constant appraisal and assimilation of the performance of buildings subjected to the acid test of day-to-day use. On the basis of such an appraisal, realistic performance specifications can be formulated, resulting in valid goals for designers of projects of a similar character.

Architects, as well as other building-related practitioners, receive little feedback about buildings in use and are chronically habituated to operating with minimal external feedback information, instead depending heavily on their personal experience. Most practices find it very difficult to use feedback, mainly because the information is widely scattered and unorganised, and because designers customarily have little time for proper information search. Furthermore, there is an ambivalence on the part of practitioners towards the practical significance of feedback information. Certainly, this lack of motivation is one of the most fundamental reasons behind the underuse of feedback information. Five interrelated reasons may explain this:

(1) The lack of formal instruction in the collection and use of information in university and professional training.

(2) An overconfidence in the intuitive design talents of practitioners.

(3) A scepticism toward the usefulness of overt feedback information.

(4) The administrative difficulties inherent in gaining access to feedback information.

(5) The Lack of time in which to search for feedback information, and organise it into a usable form.

The practice of architecture is not a static, but an ongoing, dynamic and human enterprise, so for the sake of our future professional performance it is important to make greater and more effective use of feedback from past work in terms of its overall performance. Clearly, any improvements in the efficiency of feedback information activity, either by a reduction in the overall time spent on information search and handling, or the gathering of more useful information in the same amount of time, will greatly benefit the design process as a whole.

The problems cited above may be reduced significantly by providing an information mechanism for practitioners which can secure fast and easy access to structured feedback information on existing schemes of interest. This constitutes the background to the proposal for a housing information service for planners and designers involved in housing projects.

2. OBJECTIVES OF THE THESIS

Housing projects are by their nature diverse and complex. Despite a considerable pool of knowledge about the process of housing design, it remains unevenly distributed, with few commonly accepted or clearly formulated theories about the nature of the relationships which exist between the variables comprising a housing scheme. Yet housing is the most common building type encountered in everyday life and is the area which absorbs the greatest proportion of building resources. Moreover, houses provide the shelter in which we spend the greatest portion of our time and we want the life within them to be as comfortable as possible.

Any analytical system which seeks to improve the performance of architects, planners, developers and the like, will lead to the more efficient use of the enormous resources invested in housing development, and of course, better value for clients. Such a system must be viewed with special significance in countries where housing is a major social policy concern.

The physical appearance of housing for low income groups in heavily populated countries such as Korea is, in general, taken for granted. The attitude of society may be regarded as somewhat fatalistic in this respect; rows of identical, closely spaced buildings are justified, it may be argued, by the social and economic circumstances. The scanty provision of open space, the monotonous slab blocks in parallel configurations, the resulting poor spatial quality and the lack of segregation of pedestrians and vehicles all contribute to the existence of harsh environments with the in-built factors of noise, lack of privacy and proliferation of safety hazards and vandalism. Needless to say, in such conditions, community spirit and civic pride are virtually non-existent.

The roles of the architect, planner and other related professionals in such circumstances are now more complex than ever. The ultimate goal of this study is to improve the quality of life of people who live in such environments by helping the professionals involved in housing projects to identify and assess all the relevant factors in the early stages of the design to determine what scope there may be for improvement, and to incorporate appropriate value judgements in the finished product. This thesis suggests a means to achieve this goal by exploring a structure for a computerised Housing Information Service (HIS) which will provide architects and other professionals with easily accessed feedback information derived from the analysis and appraisal of existing housing schemes.

3. CONTENTS

This thesis consists of three parts comprising twelve chapters.

Part One (Chapters 1 to 5) explores the problem area - the state of the art in design information handling - and sets out the goal of establishing the proposed HIS.

As an initial point of departure, Chapter 1 describes the three categories of design information and their interaction in the general design process. Two opposing views and attitudes regarding the flow of information and concomitant information activity of designers are identified. In Chapter 2, the information activity of designers is discussed from a phenomenological point of view, focusing on the prevailing attitudes of architects towards the importance of design information. This chapter explores problems associated with the underuse and ineffective use of overt design information, and shows how two approaches, the information-science based approach and the designer based approach, may be evolved in an attempt to cope with them. The topic of the information-science based approach is extended in detail in Chapter 3, focusing particularly on modern public information services and the possibilities offered by current technology, particularly computers. Chapter 4 sets out the conceptual background behind the proposed information service and reviews the principal criteria of project information services. Chapter 5 describes the performance specifications of the proposed HIS in terms of the potential areas for its eventual use. This is explored initially by identifying its use in the general context of design decision making. The principal categories of end-users are described, together with the information requirements unique to each category.

Part Two (Chapters 6 to 10) forms the backbone of the study. The structure of the HIS is described, together with the exploration of potential barriers to the successful realisation of the HIS, principally, informational, organisational, legal, financial and technological considerations.

Chapter 6 sets out the preliminary concerns over informational, organisational and legal issues relating to the practical implementation of the HIS. Chapter 7 explores the data structure for the HIS and describes the strategic and classificatory considerations involved. Three technological issues regarding the user-system communication of the HIS are dealt with in Chapter 8. These include the ways in which information is researched (and the role of the 'information intermediary' linking the user to the HIS), the dissemination of information and access to the HIS, and the technological options relating to the user-system communication. In Chapter 9, cost-effectiveness of the HIS is measured on the basis of establishing a new independent organisation for the smallest practical size of the service, so that a measure of the cost-effectiveness unique to each potential candidate organisation may be derived from a common yardstick. Chapter 10 describes in detail those potential organisations most suitable for the HIS implementation in Korea, together with six possible implementation strategies.

Finally in Part Three (Chapters 11 and 12), there is a discussion of the results of a pilot project designed to appraise user acceptance of the HIS. This project involved a limited number of individual practitioners and organisations in Korea and the UK.

As a preamble to the main discussion, Chapter 11 details the pilot system developed for the investigation of user acceptance, the sample of housing schemes contained within it, and the selection of participants involved in the investigation. Finally, Chapter 12 describes the level of user acceptance apparent among both a limited number of individual practitioners and certain potential organisations eligible for the HIS implementation, with particular reference to the principal theoretical concepts and potential benefits of the service.

PART ONE

INFORMATION HANDLING IN ARCHITECTURAL DESIGN AND THE CONCEPTUAL FRAMEWORK OF THE PROPOSED HOUSING INFORMATION SERVICE

CHAPTER ONE

INFORMATION IN ARCHITECTURAL DESIGN

Whilst having great variety of shades of meaning, information is generally regarded as knowledge acquired through reading about, listening to, or direct observation of the world around us. We gain information on matters in which we are to some degree ignorant, or uncertain.

Information in our complex modern society is a commodity which may be produced, distributed and exchanged like any other, with a value related to both its usefulness and the difficulty of its acquisition. It is an ability to gain access to relevant information that distinguishes the professional from the lay person.

The above view holds for the realm of architectural design. Like all day-to-day decision making, design is a process fed by a constant supply of information. In other words, the end product of design is the embodiment of a number of decisions crystallised by consideration and evaluation of relevant information. As the initial point of departure, this chapter begins by describing a classification, into three categories, of design information in the context of design decision making and goes on to explore the interactions between the categories. This classification will be used to explain the flow of design information during the design process, in which two distinct views become apparent.

1. CATEGORIES OF INFORMATION IN ARCHITECTURAL DESIGN

Information and ideas are inseparable in the sense that an *idea* is a structured organisation of information elements, selected and organised by the human mind in response to a particular problem. In this way, information in any decision-making activity may be separated into two categories according to its source of origin. These are:

(1) Information externally available outside oneself (factual data).

(2) Self-generated information in one's head.

Category (1) may be separated into two further subcategories:

(1a) Obligatory, referring to the information relating to the essence of the problem.

(1b) Auxiliary, referring to the information acting as intermediary between the problem and its solution.

Category (2) refers to newly generated information - whether it is a new idea or a solution to the given problem - which is created within one's schema from a composite of external information received and personally held knowledge and experience (see Table 1).

TABLE 1. Categories of Information in Architectural Design

OBLIGATORY (problem)	**AUXILIARY** (intermediary)	**SELF-GENERATED** (new idea or solution)
Intention of client and his requirements and budget, Site constraints, Building regulations, Codes of Practice, etc.	Technical data, Product data, Building type study, Anthropometric data, Ergonomic data, etc.	Conceptual building form, Site layout concept, Imagery of building materials, Further enquiries into auxiliary information, etc.

In architectural design, 'obligatory' information is typically something over which an architect has little or no control. It establishes bounds within which a feasible solution is to be sought. Obligatory information is set down by the client, by central and local government organisations and, in a few cases, by prospective non-client users of the building. Ordinarily, it is contained in the forms of a client's brief, conventional design guidance (design guides and design briefs) and in various forms of regulatory controls such as building regulations, building and planning acts, specifications, codes of practice, standards and so forth. It represents the policies, objectives, intentions and general advice of the various people concerned in a particular building project. Obligatory information ranges from the explicit, such as time-scale, capital expenditure, density restrictions or other numerically measurable standards, to the less explicit, even vague, for example: "the conflict between pedestrians and vehicles should be appropriately resolved ..."; "each dwelling must have adequate sunlight and daylight ..."; "all materials shall be of the highest quality ..." As the amount of this obligatory information increases, the designer's creative freedom on any given project becomes more restricted.

Once the set of obligatory information has been assembled, the architect generates an idea of the general direction to be taken and simultaneously gets an idea of what other kinds of information he will need from the external environment. A search is carried out for new information relevant to the resolution of the problem, now defined within the context of obligatory information. The new information collected in this respect may be termed 'auxiliary', since it supports the activity of decision making by acting as intermediary between problem and solution. The architect is for the most part responsible for the collection of this auxiliary information. Typically, this will cover the following areas:

(1) The study of the project site in terms of its physical and socio-economic contexts

(2) The study of the prospective building users, their normal activities and particular requirements

(3) Ergonomic and other data on physical comfort

(4) Studies of similar schemes and their actual performance

(5) Requirements for special equipment and structures

(6) Standard product and technical data

The above information is obtained in various ways, specifically:

(1) Communication with client, prospective users, colleagues, specialist consultants or organisations, building centres, product manufacturers or suppliers, commercial information services and public authorities concerned

(2) Special seminars and conferences which are relevant to one's interest

(3) Site survey

(4) Visits to buildings similar in nature to the new project

(5) Recorded sources of information in written form[1] such as reports, books, magazines, conference proceedings, monographs, specifications, sales literature and catalogues, maps, plans and drawings; and audio-visual forms such as videos, films or microfiche and microfilms

The experienced designer possesses a wealth of knowledge in his field. He will also have developed 'heuristics' - techniques or strategies found to be helpful in solving particular problems. Likewise, every architect builds and enlarges on his own idiosyncratic design schema by which design problems are approached. As information on design problems is added to his schema and reservoir of knowledge, a particular set of design strategies develops to cater for the particular circumstances of a design problem. At the same time, the need for auxiliary information may arise. Upon receipt of the required information, an architect may repeatedly attempt to tackle the given problem on a trial and error basis until a solution is found. We may refer to the stream of information generated in this way as the 'self-generated' information, being either a solution to a given problem, or a new idea resulting from the mixture of obligatory and auxiliary information and the personally held knowledge within the architect's schema.

2. INFORMATION FLOW IN THE DESIGN PROCESS

The design process is a process in which the aforementioned types of information interact and become organised, processed and translated into the end products of design. In this section, the design process is viewed from the standpoint of information flow.

There are two antithetical views on how information is processed until it is finally embodied as the end product of design. The first, upon which the traditional design process is fundamentally based, looks at the design process as largely irrational and inexplicable. It places great emphasis on intuition, imagination and chance, rather than rationality,

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1 There are three types of written information source: primary, secondary and tertiary. 'Primary' sources refer to those which describes the required information at first hand. 'Secondary' sources refer readers to primary sources, for example, the Architectural Periodicals Index of RIBA. 'Tertiary' sources carry reviews or other forms of analysis of primary or secondary sources of information, for example, the Information Sources in Architecture [1] or the Construction Information Source and Reference [2].

logic and order. This is sometimes referred to as the 'black box'[2] approach [3], the 'designerly' way of thinking [4], or the 'solution-focused' strategy [5]. The second, which provides the basis for a systematic design process, looks at design principally as a logical and explicit decision-making procedure. This might be called, in contrast to the above, the 'glass box' approach [6], the 'scholarly' way of thinking [7], or the 'problem-focused' strategy [8]. Taken to its extreme, this latter approach assumes the design process to be entirely explicable, a rational and orderly sequence of (information) activities. This implies that the design problem can be well defined and decomposable into discrete subproblems, sub-subproblems, etc.

In common with the word 'information', the term 'systematic' has a variety of shades of meaning employed and enjoyed in everyday speech. The dictionary definition which best fits our understanding of 'systematic' in the phrase 'the systematic design process' reads, "an assemblage of material components operating within a prescribed boundary and united by some form of regular interaction or interdependence to form a coherent and integrated whole."[9]

It is worthwhile to take a brief historical view of the origin of the idea of a systematic design process. Distinct from the traditional design process, it grew out of the development of the 'systems concept', originating from the emergent fields of systems engineering and operation research actively developed in the UK during World War II as a method for more efficiently deploying military equipment and resources. From the early 1960's, its adoption has been widely attempted in various design professions, with a view to coping with the ever increasing scale and complexity of design work generated by the rapid pace of post-war socio-economic and technological change and the increasing expectation of clients. . The results of using this new design process however, have not proved to be as fruitful and encouraging as people had once expected, although the degree of success (or lack of it) depended largely upon the individual methods employed. Thus, since its heyday in the 1960's, enthusiasm for the theory-driven study of systematic design process, involving the nature of design and design methods, has waned considerably. The focus has been directed more towards practical design methods and the application of information technology into design.

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2 A system in which the precise connexion between input and output variation is unknown is referred to as a 'black box'.

The systematic approach does in fact take place within the traditional approach but in an implicit, informal and even covert fashion. In this sense, the term 'systematic' attached to the formal and overt design process may be a misnomer. Instead, Bijl [10] describes the principal differences between the two approaches as follows (Table 2):

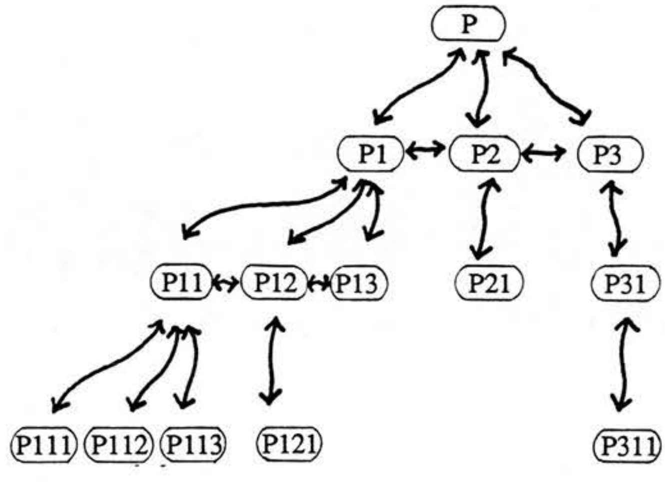
TABLE 2. Principal Difference Between Traditional and Systematic Design Approaches

	Experience based practice (Traditional)	**Knowledge based discipline (Systematic)**
Activity	Relies on explicit knowledge plus intuitive judgement of practitioner.	Explicit knowledge forms the primary means for progressing from problems to solutions.
Discipline	Informal and inconsistent; practitioners must be responsive to a volatile world.	Formal and detached;a shared base for assessing new developments.
Procedures	Arbitrary and covert	Methodical and stable, overt.

Whether we approach the design process in a traditional (experience based) or systematic (knowledge based) manner, we will invariably begin with the identification of problems whereby the problem statement and associated design criteria, be they overt or covert, are to be established. This simultaneously involves the task of generating a strategy for the collection of information. There is however, a marked difference between the two approaches in the way that information is collected and handled throughout the period of designing.

In the traditional approach to design, having come to a general understanding of the pattern of the problem, the designer will start out with a manageable amount of basic information and later progress to more specific information as the design becomes more and more substantiated through a series of sketch plans on a trial and error basis. In other words, an initial concept for the building plan, form and general construction is developed using little information other than the client's brief, the site constraints and the architect's own experience. It is then further developed and refined using more particular information, modified as necessary, in response to emerging constraints and changing requirements [11].

FIG. 1. Divergent Flow of Information in the Traditional Design Process



Thus, as far as this method is concerned, the information which is required for the whole period of designing is not absolutely predetermined from the outset. This method is characterised by a *divergent* information flow (see Fig. 1). At each level of decision making, there exists a number of potential paths down one of which information should continue to flow. Taking the point (P) in the above figure as the stage of problem formulation, the designer must, at each decision-making level, not only evaluate each potential onward path, but also gather and analyse the information relevant thereto. Thus the next path in the flow will not be determined until the designer has evaluated all potential paths and made a decision (although the decision may, in many cases, be tentative). If it should prove that none of the possible branches from a particular decision-making level are satisfactory, then the designer is forced to retreat back to the previous (higher) level where other potential paths exist. In the figure, should branches P111, P112 and P113 prove unsatisfactory, the root of these three, P11, must be discarded in favour of another at that level, P12, P13, and so on. This process of elimination often leads right back to (P), the original problem formulation. The path of information flow is in effect not hierarchically but arbitrarily determined: the flow at any one point may jump up or down any number of levels or move horizontally within one level. For these reasons, the information search, whether it takes place frequently or not, does not cease until the design has reached completion. This can also be explained by the observation that, while on the one hand the amount of information an architect can accommodate at any one time is limited, on the other, design progresses from the general and abstract to the particular and concrete according to deductive logic, in which any prior imposition of a part-solution may adversely affect the design as a whole.

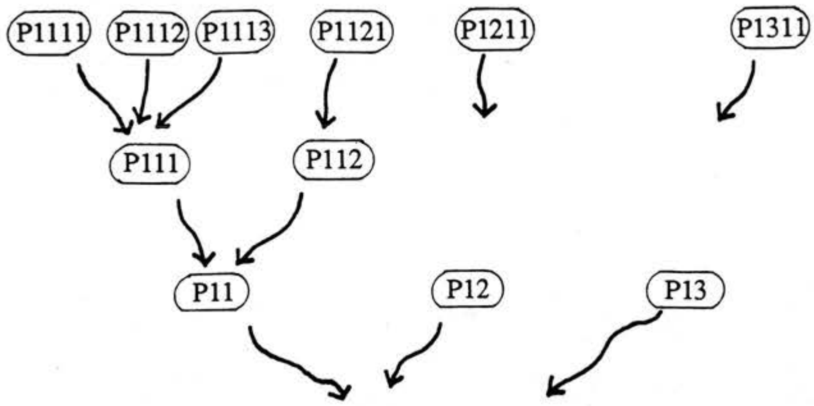
By contrast, a 'systematic' approach aims to obviate many of the difficulties and problems presented above. In the extreme sense, it assumes that the information seeking activities of the architect can progress by a series of well ordered and logical steps from the inception to the completion of a design task, and thus, that they can be packaged at a particular instance of the design process. Information required for the entire design process is collected from the very earliest stages, or else at certain predetermined stages in the design. An exhaustive listing of design requirements is initially prepared from the observance of a problem context, which might otherwise be used in the traditional design process as a checklist for the subsequent appraisal of solutions generated in the intermediate or final stages.

The fact that all necessary information for the entire design process is predetermined may imply that the form of the end product of design was sought in an overly constrained or deterministic manner, not taking into account the myriad permutations of form made possible from the combination of many choices at various levels of decision making. Best [12] observed in both the theoretical attitudes typified by Alexander and the formal design methods prevalent in architectural schools throughout the 1960's, that there was a distinct tendency for the supposed analytical diagrams of information requirements to be directly transformed into a building configuration.

In reality, it is not possible to predetermine, and therefore to collect, all information necessary to a particular stage of the design process, especially at the early stages. Decisions on part-problems affect decisions on other part-problems, both those immediately at hand and those forthcoming, each of which will have different information requirements proving difficult or impossible to forecast. In addition, designers often encounter situations where decisions must be put off until the very last minute of the design process - this occurs for several reasons, typically: client indecision, uncertainty of planning approvals, concurrent commitment of designers to other projects, and so forth.

A further typical problem with this approach is the lack of criteria for final evaluation of a design product, since it is these very criteria that have caused the design in the first place. It is exemplified by the experience of Hanson [13] who had once in his student days applied Alexander's methods to his design projects. Having researched the most exacting information requirements at the outset of design, he found that the information (i.e. design criteria) produced was virtually indistinguishable from the building regulations or the standard checklist for normal design procedures.

FIG. 2. Convergent Flow of Information in the Systematic Design Process



Once information on design requirements has been collected, these requirements are further subdivided into independent subsets. If there are many requirements to be subdivided, a computer may be found useful. As a further step, the subdivided information is organised into a hierarchical structure. Within this structure, design problems are sequentially solved from the lowest level of subproblem to the highest - the final design solution. Thus in the systematic design process, information flow may be said to be *convergent* (see Fig. 2). The shortcomings of the theoretical nature of this approach are not only that it tends to disregard the horizontal relationships of design requirements, which can seldom be independently isolated and examined, but also that it prevents the modification of earlier design intentions as the decision-making process advances. Thus it divests the design process of any degree of procedural flexibility it might have: alternative decisions can only be made at the very beginning of the design process by modifying the conditions of, and relations between, design requirements. In addition, it tends not to allow the incorporation of 'lateral' thinking [14] which is spontaneous and open to new (and possibly threatening) insights, by stepping outside the problem and attacking it from all sides. This inherent shortcoming may lie at the heart of the difference between the systematic approach and the traditional.

But for all these criticisms, the emergence of systematic design processes has at least encouraged improvements in some aspects of the designer's information activity. Design problems are more thoroughly examined; even small areas of the problem are now taken into early consideration, areas which were likely to be neglected in the traditional design process. This allows the designer in the first stages of design to judge how much information to gather for a given problem [15]. The systematic method eases a number of very practical considerations: teamwork and the division of tasks, especially for large scale projects, are made possible; communications between all concerned information sources, such as client, prospective users, consultants, are made at the proper time of information needs during the design process; regular feedback to the original decision-making groups or individuals is ensured, together with proper records of the process leading to those decisions as a reference for future projects [16]. In addition, objective criteria for measuring building performance have begun to be established and the application of design tools such as computers have been widely introduced into the practice of architectural design.

3. THE ACQUISITION OF EXTERNALLY AVAILABLE INFORMATION DURING THE DESIGN PROCESS

There are therefore two distinct and opposed approaches towards design and its associated information activities. However, no one individual designer stands at one extreme or the other, although a general inclination in design attitude may often be clearly discernible. Design arises from a combination of these two complementary attitudes, for each of which there exists a distinct pattern of information activity among practising designers. The polarity between them may be thought of as analogous to that between the analytic ability of 'left brain' and the holistic ability of 'right brain' as suggested by Ornstein [17]. A good designer will instinctively alternate between the two.

With the divergent pattern of information flow in the traditional design process (Fig. 1), a designer will inevitably face two problems associated with information gathering at each level of decision making.

Firstly, as previously mentioned, there is a limit to the experience and knowledge of the whereabouts of relevant information a designer may possess. Thus the designer may simply be unaware of the existence of relevant information with which to explore any new ideas or potential design solutions.

Secondly, even if he or she were aware of the existence of such relevant information, there is the common problem of simply laying one's hands on it. This is in seeming contradiction to the present-day 'information explosion'. It appears that the huge volume of information now available to designers makes the procurement of any particular relevant item increasingly difficult. Locating the requisite information tends to be time-consuming and costly. Even if the information can be found, the level of detail provided may, in many cases, be unsatisfactory. And if there should be sufficient information available at hand, there may be a lack of time for its proper evaluation and organisation, as information is not always available in a form that can readily be applied to a design problem.

Those problems associated with information in the traditional design process generally apply to the systematic. However, with the systematic design process, extensive collection of information is of the utmost importance. Successful design is for the most part dependent upon the quality of information researched in the initial stages of the design process. Thus the time required for information collecting will commonly take up a great proportion of the available design time. Knowledge about, and ease of, access to relevant information are critical to design efficiency in the systematic design process.

Designers seem neither able nor willing to cope with these problems in a positive way. In practice, they place a heavy reliance upon themselves as a major source of information and tend not to become intensively engaged in the researching of externally available information. This tendency is more discernible among older designers than among younger and less experienced designers [18].

So far in this chapter, a categorisation of design information in architectural practice according to the fundamental sources of origin has been described, followed by a discussion of information flow and interaction in two different design approaches. Finally, the problems inherent in the information activity of designers during these approaches have been explored to lay the groundwork for further enquiries in the following chapters. Clearly, there is no one single cause of the problem but rather a collection of individual causes contributing towards the whole. In the next chapter, this will be explored in greater depth.

CHAPTER TWO

THE ATTITUDE OF ARCHITECTS TOWARDS DESIGN INFORMATION

As Rosenberg, an information scientist, declared, people do not like to work too hard or travel too far for their information [1]. The principle of least effort is a universal truism in information gathering and architectural practice is no exception to this rule.

An information search is only prompted when there is an indispensable need for particular information (for which ignorance would be no excuse), or when there is a temporary 'surplus' of manpower (as with the engagement of student trainees). Information channels are chosen on the basis of ease of use and accessibility regardless of the quantity and quality of information. It is true as well, that if an architect cannot find the desired information quickly, it will simply be ignored.

Empirical studies on the demands and subsequent uses of information, often called 'user studies', are now quite numerous in certain scientific and technological disciplines. They are however, as yet few and far between in the architectural profession, and the studies that do exist rarely go into the subject in any depth.

Studies of this nature involve the use of survey techniques (comprising observations, interviews, questionnaires, diary methods, etc.). In many cases, the design of surveys imposes problems of methodology, with a variety of factors proving critical to the execution and results of a survey. Most critical are the size and characteristics of the selected sample, the timing and environment of the survey, and the content and format of survey media. Identical questions may get wholly different responses according to the balance of these factors. Additional problems inherent in surveys are as follows [2]:

(1) Limitations of the informer, e.g. deliberate falsification.

(2) Limitations of the surveyor, e.g. biased questioning.

(3) Limitations inherent in the nature of survey, e.g. time and financial expenditures, misinterpretation, the problem of communication, and over-simplification of the real world.

Any analysis of results and the drawing of conclusions pose yet further problems, especially in a field such as architecture which is conspicuously lacking in sound theoretical or conceptual frameworks. Nevertheless, survey findings on the behavioural aspects of architects in dealing with design information suggest that there still exists a considerable degree of consensus. In this chapter, the available research findings are investigated in order to provide an overview of the information habits and needs of architects. Particular emphasis shall be laid on the following questions:

(1) Which sources and types of information are particularly researched by architects during the course of designing, and what particular types of information are considered to be most difficult to acquire?

(2) What are the major reasons which deter architects from making more extensive searches for information?

(3) In practice, what proportion of an architect's design effort goes into an information search?

1. SOURCES AND TYPES OF DESIGN INFORMATION PREFERRED BY ARCHITECTS DURING THE DESIGN PROCESS

There is an undeniable tendency amongst architects to avoid written sources of information. A survey in the mid 1960's conducted by Burnette and Hershberger [3] gives strong evidence for this, based on information supplied by 19 American architects. Table 1 below is a summary of the results of the survey, showing various information sources used for hospital planning, ranked in order of frequency of use.

TABLE 1. Rank of Information Sources Used For Hospital Planning

Sources and Methods	Used Total
1. Administrators and department heads	106
2. Conversation with individuals	104
3. Participation in a meeting or conference	103
4. Experience, chance and current awareness	98
5. Medical and paramedical staff	91
6. Reference books and professional journals	81
7. Codes, standards and operating rules	75
8. Reference to private files and literature	72
9. Periodicals and review articles	72
10. Visits to existing facilities and displays	70
11. Minutes and reports	69
12. Consultants and advisors	69
13. Correspondence	66
14. Research and regulatory agencies	64
15. Directors and trustees	62
16. Service staff	62
17. Architects, engineers and staffs	51
18. Use of information service or library	50
19. Bulletins, announcements and advertisements	37
20. Abstracts, indexes and bibliographies	22
21. Research papers and student theses	19

SOURCE: C.Burnette & R.Hershberger, "User Research," An Information System for Hospital Planning, USPHS 00420-01, Inst. for Environmental Studies, Univ.of Penn., 1967, p.35.

This table indicates the architect's reliance on informal contacts and ready-reference by showing that informal sources (1-5) are most often used and that formal information sources (18-21) least used. Although the focus of the survey was directed towards the sources and methods of gathering information used by architects involved in hospital planning, the findings seem to apply generally across all practices.

The most vigorous and detailed studies in this area have been carried out at the Institute of Advanced Architectural Studies (IAAS) at the University of York, under contract to the Building Research Establishment (BRE). In one study, completed in 1982 [4], information was seen not only as that which is externally available, but also anything that influences design decision making. Specifically, it classified information into four categories:

(1) Outside events and agencies, and associated constraints

(2) Experience

(3) Personal choice and tradition

(4) Recorded design data

The findings from surveying 12 jobs in 6 local design offices again disclosed that the first three kinds of information have the strongest influence, especially in the earlier design stages, revealing the common tendency of designers to avoid formal written sources of information.

This tendency may be attributable to the cumbersome nature and overall slowness of formal communication. The designers' preference for informal communication still seems to persist, although in recent years there has been some slight progress owing to the growing availability of various forms of written information tailored to meeting the particular requirements of designers.

An account of the widespread preference for informal channels of communication is given by Allen [5], who argues that the preference for such channels is determined by the nature of a subject field. According to him, the information-processing system of 'science' displays an inherent compatibility between input and output, i.e. they are both in verbal form (see Table 2). However, he goes on to argue that for 'technology' (for which we may here read 'pragmatic design'), there is a fundamental and inherent incompatibility between input and output. The physically encoded format of the output of pragmatic design (e.g. paintings, sculptures, buildings, etc.) makes it very difficult to retrieve the (verbal) information necessary for input to further developments. Because outputs (and resulting feedback) cannot serve directly as inputs to the next stage, reliance upon the written word for the designer will be much less than that for the scientist.

TABLE 2. Information Processing in Science and Technology

Input	System	Output
verbally encoded information (papers and discussion)	→ Science →	verbally encoded information (papers)
	direct feedback	
verbally encoded information (papers and discussion)	→ Pragmatic Design →	physically encoded information (hardware and other products)
	↳ verbally encoded information as a by-product (documentation)	
	problematic feedback	

SOURCE: Adapted from T.J.Allen, Managing the Flow of Information, MIT, 1977, pp.2-5.

In the IAAS study [6] mentioned previously, we find a listing of written sources of information most commonly used by architects in practice (Table 3):

TABLE 3. Information Sources Preferred in Architectural Practice

Building Regulations and other Acts of Parliament
Planning requirements
Client brief
Official bulletins (DOE design guides, etc.)
Office records of previous designs
AJ handbooks and Information Sheets
General reference books (e.g. McKay)
General price books
Specifications
Building reviews in architectural journals
British Standards and Codes
BRE Digests and Current Papers
NBA publications
Trade Association publications
Trade literature (independent of Trade Associations)

SOURCE: M.Mackinder & H.Marvin, Design Decision Making in Architectural Practice, York: IAAS, 1982, p.78.

Of the sources listed, the most frequently used were found to be technical references, i.e. trade literature, British Standards, official bulletins and notes, and miscellaneous general reference books. These were mainly used in the detailed design stage. The information contained in such references covers technical information together with costs and dimensions for equipment, structures, building products, and the like; failure to consult this kind of information will inevitably lead architects into serious difficulties. It was further identified that architects limit themselves to only a few favourite reference sources: they tend to use a small, somewhat arbitrary, personal selection of the available technical information. These sources are chosen on the basis of each designer's assessment of whether the information in a document is quick and easy to understand and use.

Further studies concerning preferred sources of information (Burnette and Hershberger [7], Goodey and Mattew [8], and Atkins [9]) demonstrate a marked tendency towards traditional sources of technical information such as trade literature, magazines and journals, reinforced by telephone and personal contact with trade representatives. Supplementary sources of information such as design centres, research literature and much else seem to be largely used only when there exist special problems.

Cohen [10] conducted a survey, with subjects from selected offices of different sizes in Wisconsin (USA), into the rating of categories of information by the difficulty of their acquisition (see Table 4). He found that, from a total of eight information categories, 'user needs' turned out to be precisely the kind most difficult to obtain, followed by 'activities and functions of buildings'.

TABLE 4. Categories of Hard-to-Get Information

Categories of Hard-to-Get Information	No. of Respondents
User needs	17
Activities & Functions of Buildings	16
Zoning and Codes	7
Site	4
Construction and Structure	4
Building Components	1
Appearance and Form	1
No Response	18
TOTAL	68

SOURCE: U.Cohen et al., "Information Needs and Information Use in Architectural Offices," Wisconsin Architect, Oct. 1976, p.11.

In practice, architects rarely bother to get hold of such difficult information. This is further demonstrated by Allen [11] who reveals that architects largely ignore information pertaining to the social sciences. Although not specifically categorised in the list given above, it would seem to be equally difficult to obtain information on the performance of previous design treatments with respect to similar basic problems. This kind of information is often referred to as 'feedback' information, and may be considered a scarce commodity. Where it does exist, it has been obtained and converted into a usable form only at great expense of both time and money. The truth of this is repeatedly argued by practitioners and researchers alike.

The reasons for these types of information being customarily difficult to locate may be inferred from the nature of the information itself. Firstly, the information is often particularly difficult to verbalise concisely and precisely. Secondly, there are certain communication difficulties in the absence of direct experience of the subject matter. Lastly, there is an absence of a standardised and widely recognised terminology and recording methods.

2. THE UNDERUSE OF DESIGN INFORMATION

As a second topic for discussion, the major reasons which deter architects from making adequate searches for information are dealt with below.

In general, use of design information is limited by architects and seen as a time-consuming activity. The majority of architects attribute this to presentation problems arising out of the form and quality of design information, and ultimately to a lack of time and money. They complain that the present fee scale for the profession does not make allowances for intensive information searches. There are a number of studies which have looked into this problem area in an attempt to improve the use of design information (Bishop and Alsop [12], Goodey and Matthew [13], the Directorate General of Development in the Department of Environment [14], Powell and McAra [15], Cohen et al [16], Burnette [17], Mackinder [18], Ritter [19], Powell and Nichols [20], Bonshor and Harrison [21], and many others including studies carried out by the IAAS [22, 23]). Collectively their findings may be summarised as follows:

(1) Availability and accessibility :

The requisite information is simply not available to hand. Although architects feel that they are overwhelmed by a flood of information, access to any particular piece of information is too time-consuming and costly.

(2) Awareness :

Architects simply do not know what exists.

(3) Applicability :

Information is usually too general to answer a specific problem because much of the information is intentionally generalised so as to cater for all circumstances.

(4) Conciseness :

Information is often unavailable in a concise and readily understandable form suitable for using directly into problem solving, i.e. it is lengthy, wordy or circumlocutory. The assimilation of the content of such information demands considerable time.

(5) Essential contents :

Manufacturers' literature often lacks information on prices and test performance, which are very important design criteria.

(6) Communicability :

Information is presented in ways unintelligible to most architects. For instance, test performances are often presented in a way that is only communicable to the highly technical professions such as engineering, physics, chemistry and so on.

(7) Authenticity :

Product and equipment data is often debased by glossy advertising: the possible weakness of a product is often kept secret! Many architects have little confidence in the quality of such information. It is for this reason that they limit themselves only to information certified by recognised authorities.

(8) Obsolescence :

Certain types of data, such as product and equipment data, rapidly become outdated and may be considered rather risky to use without confirmation.

Communication of information is a two-way street. Further to the problems of information demand, there are problems imposed equally on the part of the information suppliers. Typically these are [24]:

(1) That it is difficult to make sure that the information reaches the right person or organisation and so the suppliers often feel that their information is wasted. Even when it does go to the proper organisation, it is not always passed on to all the interested personnel.

(2) That the wide diversity of products, plus the varied methods of supplying information, make the up-dating of information difficult. This is even worse in the case of price information because of frequent price changes.

(3) That the publication of material in a satisfactory format and with good visual quality is expensive and beyond the resources of many suppliers and manufacturers.

(4) That low profit margins in the industry do not encourage manufacturers' promotional efforts.

(5) That feedback is extremely difficult to obtain on such matters as the effectiveness of publicity, the origins of enquiries, competitors' sales and products, the customers' requirements and on the designers' ideas.

The conflicting requirements between users and suppliers of information are not likely to be solved in the near future. The underuse of information however, does not seem to be due solely to its inconvenient form or inadequate quality. As Lera, Cooper and Powell [25] point out, it would be rash to assert that improvements in the form and quality of information would eventually lead to its greater use by architects. Another equally important reason for the underuse of design information lies in the ambivalent attitudes held by architects themselves: while the majority of architects agree that good information is a necessity, in reality, they show a general unwillingness to consult design information. This is endorsed by the results of surveys conducted by Asprino, Broadbent and Powell [26], Powell and Nichols [27], Cooper and Crisp [28] , the IAAS [29, 30, 31] and many others. In fact, a true understanding of information use may involve rather abstract concepts of human motivation which are difficult to establish with any certainty.

To summarise, three interrelated reasons seem necessary to account for the underuse of design information by architects. The first is that architects are chronically habituated to operating with minimal information, instead relying heavily upon personal experience. Secondly, architects, perhaps as much as other groups of professionals, prefer to seek information by simple and informal methods (e.g. talking amongst colleagues, browsing the literature, etc.). These first two reasons must be dealt with at the psychological level, that is, beyond the phenomenological. Lastly, during the traditional university and professional training, little instruction is given to architecture students about how to collect and use information. In only a very few instances has formal instruction of this kind been instituted as a part of the design curriculum.

3. TIME AND EFFORT INVOLVED IN INFORMATION ACTIVITY

This section focuses on the proportion of an architect's effort which goes into information search during the design process.

Very little is known about the amount of information that is required for a particular task. The amount of adequate information required to complete a design task changes with the nature of the project and the architect's own experience. There is some evidence to suggest that too much information is in fact disruptive; however, as stated previously, architects are used to operating with minimal amounts of design information. Yet the time and energy which architects spend upon information searching and handling is not trivial. In fact architects spend a considerable part of their design time managing or searching through mismanaged information. Redpath, in his opening address to a conference organised by the Construction Industry Research and Information Association (CIRIA) in 1969 [32], claimed that the amount of time designers spend searching for information would be between 10 and 20% of their total design time, collectively equivalent at that time to 10 million pounds a year. This proportion may well have increased since then due to the increased amount of information requirement caused by the ever-increasing scale and complexity of design projects.

It might be presumed that different proportions of design time are spent on information activities by architects belonging to different types of office. However, a survey [33] conducted by the RIBA Council during 1960-61 revealed little variation across the whole spectrum of office types. This somewhat surprising result may be an interesting area for further investigation.

There are very few studies which have dealt with the overall activities and corresponding time efforts of designers at work. One of the earliest studies, the AIA survey in 1950 of over 3,000 U.S. offices [34], investigated the distribution of architects' time spent on 28 types of activity (Table 5).

TABLE 5. Activity Distribution of Architects at Work

Working drawings	17.9%
Architectural design	15.2%
Overall activities of general practice	11.5%
Administration	10.7%
Specifications	6.4%
Field supervision	9.7%
Client relations	9.2%
Other 21 activities	19.4%
TOTAL	100.0%

SOURCE: T.C.Bannister, The Architect at Mid-century: Evolution and Achievement, New York: Reinhold Publishing Corp., 1954, pp.37-38 and table 28 in Appendix.

Over 80% of the architects' time was spent on the first seven activities, whilst the remaining 19.4% was distributed thinly over 21 other activities, none of which represented any information oriented activity. The place of information search in the design process was not reflected in the earlier surveys on the activities of architects at work, suggesting that the significance of information activity had not been properly appreciated. The indifference towards information activity has changed gradually over the years. Later surveys started to enquire about the place of information activity in an architect's overall activities.

In 1960-61, the RIBA Council surveyed 69 offices in England and Wales [35], on how architectural staff spent their time on the various activities specified in Table 6.

TABLE 6. How Architectural Staff Spend Their Time

1. Drawing: design, revision, checking -----	55.0%
2. Meetings, discussions, telephoning (all concerning the job) including site surveys ---	14.5%
3. Site supervision ----------------	2.5%
4. Travelling ------------------ ---	3.0%
5. Reference to technical or trade literature or standard data ---------------- ---	1.5%
6. Staff supervision, directing activities of team --	3.0%
7. Correspondence, preparation of reports -----	8.0%
8. Searching for, and filing, drawings, documents and letters ---------------------	1.5%
9. General office activities; administration -----	4.0%
10. Absence due to sickness, attendance at school, tea breaks, etc. (but not lunch) ----------	7.0%
TOTAL	100.0%

SOURCE: RIBA, The Architect and his Office, London: RIBA, 1962, p.49.

The activities which can be regarded explicitly as information activities in Table 6 are (5) and (8), which together count for only 3% of the total design time. A much more liberal estimate is that of the Building Research Station (BRS) study [36], which estimated that designers spend from 10-20% of their time searching for information. It added further that a great deal of time goes into 'translating' information from the collected form into a usable form.

An interesting survey was conducted by Evans et al. [37] in 1971, which employed more scientific techniques of observation. Along with questionnaires and interviews, it incorporated a time-lapse camera for the observation of ten design projects. The technique enabled the changing patterns of activity of architects to be observed. Table 7 presents their list of 'activity profiles' and the proportion of time spent by their subjects on each activity at both an early sketch stage (I) and a much later design stage (II).

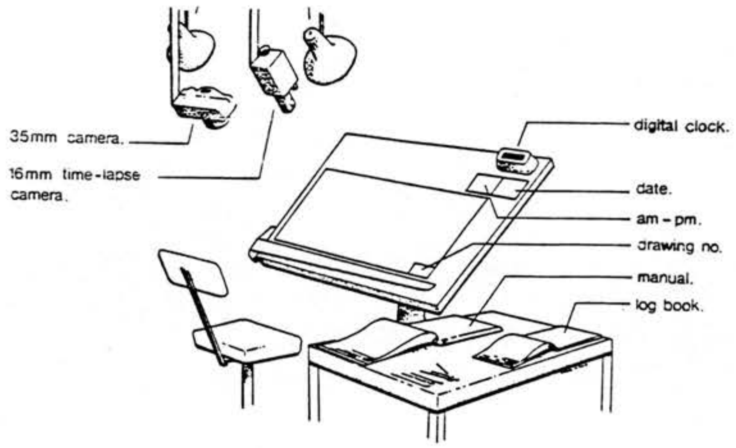
TABLE 7. Activity Profiles

Activities	% Total Time	
	Stage I	Stage II
Setting up paper -------	0	0
Referencing buiding manuals, previous drawings, etc. ---	0	22
Writing annotation and other -----------	2	14
Drawing ----------	56	17
Erasing -----------	0	3
Measuring ----------	5	3
Reviewing ----------	14	18
Miscellaneous --------	23	23
TOTAL	100%	100%

SOURCE: C.R.Evans, P.A.Purcell & J.Wood, An Investigation of Design Activities using Analytic Time-lapse Photography, Division of Computer Science, National Physical Laboratory, Report Com. Sci. 50, July 1971.

However disarmingly scientific and interesting this kind of technique is, the problem with this survey is that its finding is based on an experiment with only a few local county architects and fails to consider their educational and work backgrounds. Whether they were acting naturally in a controlled environment with the camera's presence (Fig. 1) is also debatable.

FIGURE 1. Experimental Set-up



SOURCE: C.R.Evans, P.A.Purcell & J.Wood, An Investigation of Design Activities using Analytic Time-lapse Photography, Division of Computer Science, National Physical Laboratory, Report Com. Sci. 50, July 1971.

Nevertheless, the findings reinforce the general contention that designers start out with a bare minimum of design information, gradually building up material relevant to the project as it progresses (this is again confirmed by a survey conducted by Marvin [38] in 1983). A further noteworthy aspect of the survey by Evans et al. is that the researchers' own interests in information activities are clearly reflected in the design of the classification of activities.

Needless to say, any selected classification greatly influences the nature of the results of a survey. More recently, surveys have begun to be carried out on more detailed classifications. To take an instance of a case study based on a more detailed classification of architect's activities, the Building Design Partnership survey quoted in Broadbent [39] shows that the average young architect spends at least 7.6% of his or her time in information research. In the survey, all the activities of a young job architect are grouped into six categories, each having their own detailed subgroups as follows (Table 8):

TABLE 8. Percentages of Time Spent in Various Activities

Drawings and associated activities:		Information-seeking:	
Drawing and lettering	19.2%	Referring to catalogues	1.2%
Measuring	2.3	Referring to drawings	1.9
Selecting colour scheme	1.2	Referring to specifications or bills of quantities	0.6
Erasing	1.7		
Searching for pencil	1.6	Checking specialists' drwgs.	0.1
Sharpening pencil	0.3	Searching for drwgs.	2.3
Setting up work space	2.7	Searching for other info.	0.9
Colouring prints	3.9	Other info. away from work place	0.6
Obtaining prints or drwg.paper	0.4		
Folding prints	0.1		
Subtotal	33.4%	**Subtotal**	7.6%
Discussion & verbal communication:		**Letters & written communication:**	
Discussing w/ colleagues or admin.	14.5%	Dictating letters	1.0%
		Writing letters	1.0
Internal telephone	0.5	Signing letters	0.3
Consulting quantity surveyor or heating & ventilation engineer	1.7	Reading correspondence	1.0
		Making notes	1.0
External telephone	4.0	Preparing reports, specs., financial	1.1
Discussion w/ contractor, client or rep.	0.7		
		Writing schedules	0.3
On site or visiting client	8.3	Costing work, filling in time sheets or expenses sheets	0.6
Admin. or design session	1.4		
Subtotal	31.1%	**Subtotal**	6.3%
Thinking:		**Miscellaneous:**	
Thinking	9.5%	Calculating	1.0%
		Walking about	2.8
		Waiting	0.4
		Personal	2.3
		Other	5.6
Subtotal	9.5%	**Subtotal**	12.1%
TOTAL		100.0%	

SOURCE: G.Broadbent, Design in Architecture, New York: John Wiley & Sons Ltd., 1973, pp.205-6. (Based on figures provided by Building Design Partnership, Preston)

The above analysis allows us to reasonably infer that, apart from overt 'information-seeking' activities, there are still many activities covertly or informally involved in information searching and handling. It suggests that the figure of 7.6% only represents the time spent on laboriously collecting recorded information such as catalogues, drawings and specifications. We may reasonably infer from the analysis that a considerable proportion of verbal and written communication also involves the activities of information search and handling.

The list of studies described in this chapter is by no means exhaustive. It is extremely difficult to gain a completely accurate picture of design related information activities for many reasons. Firstly, each design project has a different time scale and complexity (by type and size), each of which requires different levels of information activity. Secondly, although it contradicts the finding of the survey of the RIBA Council [40], the pattern and intensity of information activities of architects might well vary with the size and characteristics of the practice to which they belong (e.g. public versus private offices, specialist versus general practice, etc.). Thirdly, at the individual level, designers have quite different approaches to the amount of effort they put into information activity. Fourthly, continuous observation of a design programme is rarely possible because of the designer's inevitable commitment to other projects and to concerns quite apart from that of design. Fifthly, there is always the limitation of time and money on the part of investigators: surveys of this nature are most likely to be conducted at just one of the many stages of the overall design development resulting in a very partial view of the role of information in architectural design. Lastly, and most importantly, we have a somewhat poor understanding of the design process taken as a whole. These make any generalisation of survey findings rather difficult.

Nevertheless, it is true to say that a great deal of architects' design time is spent in information-seeking, even if much of it is profoundly informal and might not be considered to be an active search. Moreover, it may be generally inferred that the time and effort spent on information activities have been gradually increasing in the light of the growing scale and complexity of contemporary building practice, and the growing awareness of architects to the importance of information. Clearly, any improvements in efficiency in this area (whether it be a reduction in the overall time spent on information search and handling, or whether it represents the gathering of more readily usable and useful information in the same amount of time) will greatly benefit the design process as a whole.

4. THE COMPLEXITY OF USER STUDIES

In conclusion, architectural design is characterised by a number of idiosyncratic features that make the assessment of information use and needs by architects particularly difficult. The user studies which exist have concentrated solely upon fragmented parts of the total sphere of architects' information activities and the methods of investigation employed are themselves idiosyncratic and heterogeneous due to the absence of sound theoretical and conceptual frameworks. Further problems in current user studies lie in the tendency of researchers to concentrate too heavily upon too few variable factors, avoiding the wider complexities of reality.

There exist many factors about which we still have no clear knowledge which nonetheless have considerable impact upon working architects attempting to draw upon the elaborate communication network that connects them with sources of necessary knowledge. For instance, the selection of a suitable communication channel, the effect of information quality, quantity and diversity on productivity, etc. These are in turn influenced by the following fundamental factors:

(1) Individual and personality variables :

Educational background, professional experience and qualification, motivation, attitudes and beliefs, age and health, decision style, work habits, etc.

(2) Contextual variables :

Cultural, socio-economic, institutional, organisational, technological, physical environment in which a designer works.

It is unlikely that any one single method could be appropriate for the assessment of the dynamic nature of information research and subsequent use by architects. The intertwining of many complex factors will continue to preclude proper assessment until we can construct mechanisms for the objective measurement of designers' needs and behaviour patterns with respect to information.

As Lera [41] has suggested, two distinct types of information research may be clearly distinguished. The first is the information-science based (information-oriented) research with its focus on the form, quality and communication medium of information. It assumes that improvement in this area would lead architects to the wider and better use of information and ultimately to producing better buildings. The second is the behavioural science based (designer-oriented) research which focuses instead on the behavioural aspect of designers in their information activities. It assumes that the mere possession of information does not guarantee its utilisation by designers and thus improved productivity and performance will not be achieved without an accompanying improvement in this area.

The proponents of information rich design environments pay little attention to the behavioural aspect of architects, and naturally, vice versa. Each approach is meaningful and worthwhile in its own right, but both would be greatly enhanced by a conjunction of the separate disciplines in user studies. In reality, they greatly influence each other. For example, emerging new information technologies shape the information activities and behaviour of users; equally, the behavioural patterns of information users motivate the emergence of new methods or devices for information handling. They meet together in the study of information needs and usage. Unfortunately, we, as architects, are not able enough to look into this area on our own. We need considerable contributions from other bodies of knowledge, particularly those of information science, psychology, behavioural science and other related fields.

CHAPTER THREE

INFORMATION RETRIEVAL AND HANDLING SYSTEMS FOR ARCHITECTURAL PRACTICE

The purpose of user studies is to define problems inherent in information activity as they exist in practice, and thereby to provide a direction, not only to those information users, but also to those involved in the design of improved systems. In the preceding chapter, an attempt has been made to explore some of the information-handling activities of architects, together with their associated problems. The frequently cited problems of underuse and ineffective use of design information have led to the evolution of two distinct remedial approaches: the information-science based and the designer based approach. This chapter is concerned with the information-science based approaches, with particular reference to the use of current information technology in the architectural profession.

The mere possession of vast quantities of information does not guarantee its effective utilisation by those who require it; many studies of architects' searches for information show that they often simply cannot find (or therefore use) relevant information in the limited time available. The lack of readily usable information militates against the productivity of architects and the quality of their design products. The extent of the problem is not easily assessed, but a survey by the Department of the Environment (UK) on design faults revealed that 26% of such faults were associated with deficient design information [1]. To obtain the right information at the right time and at the right cost under the present circumstances of a continually expanding information reservoir is a serious concern for architects in this resource-conscious society. Traditional ways and means of information handling are losing their effectiveness to cope with this problem, particularly within the constraints of current design time schedules. Accordingly, increasing attention is being given to the possible use of information technology in design.

1. AN OVERVIEW OF THE USE OF INFORMATION TECHNOLOGY IN ARCHITECTURAL PRACTICE

Since its rapid emergence in the mid 1970's, information technology has been widely introduced into various fields of design. Like designers in other fields, architects are increasingly liable to be influenced by the use of information technology in professions and practices impinging on their own. It is also true however, that they have been slow to adopt its use in practice. In many cases, current information technology using computers can replace human labour in particularly tedious jobs, such as repetitious calculation and drawing up of various kinds of schedule, and can carry out these jobs at great speed. Computers can also perform analyses which would not otherwise be practicably feasible, e.g. experiments in simulation and the monitoring and control of buildings.

The current uses of information technology in architectural practice may be categorised into three broad areas - (a) storage and retrieval of design data, (b) generation of preliminary design solutions and (c) prediction of performance - although, according to individual system designs, these distinctions will commonly be blurred around the edges. Between them, these categories encompass information handling and retrieval, construction management, accounting, structural analysis and design, environmental simulation and calculation, visualisation (including drafting) and design appraisal.

An increasingly broad range of versatile computer software, designed specifically for use by architects, is becoming available as a result of the rapidly decreasing costs and widening availability of powerful and reliable computer hardware. However, for all its seeming power and effectiveness, computer applications in architectural practice have been surprisingly few. In the early days of computer-aided architectural design (CAAD), the huge capital investment required for computer hardware could only rarely be justified, and, even now, the serious application of computing requires considerable financial commitment.

The need for large scale capital investment however, does not explain alone the present underuse of computers by architects. One critical reason seems to be architects' preconceptions of, and opposition to, a mechanistic and depersonalised approach to design. The computer is seen as an instrument of this evil, constraining the freedom of design decision making. This preconception of architects is perhaps partially justified, since, as is observed from the failure of the first generation design methods in the 1960's, many computer programs have been developed on the basis of overly idealised or artificial premises. Furthermore, as Rosenbrock [2] suggests, the design of CAD/CAAD systems has not been properly directed towards accepting and manipulating the skills and empirical knowledge of designers with a view to giving them improved techniques and facilities for exercising this skill and knowledge. But an equally important reason for the continuing underuse of computers is that architects have been generally unwilling to examine thoroughly the possible benefits of using computers, and the proper circumstances in which they can be beneficial [3].

Clearly, humans and computers have different strengths and weaknesses. One must accept both the creativity, judgement and intuition peculiar to humans, and the speed, accuracy and attention to detail peculiar to computers. When the strengths of each are combined, the application of computing resources will reach an ideal. Technology and society respond dynamically to each other. The introduction of a new technology to a society, especially to a society steeped in the equilibrium of tradition, will always suffer initially from a degree of social resistance.

2. THE PRACTICAL USES OF INFORMATION SYSTEMS

As distinct from other uses of information technology, an information system (or more accurately, an information retrieval and handling system) may be defined as a system which stores, organises and disseminates information, manipulating raw data into a form useful to users. A good information system will structure and process information in the most efficient way possible and ensure regular updating of its data contents, thus providing an effective basis for sound and timely decision making.

Any system that processes and produces data may be said to be an information system. In this sense, the computer applications previously quoted can all be said to be information systems since they operate on data input. But here, a stricter definition confines the use of the term to those systems processing data, not as hypotheses to be tested (i.e. model oriented systems for representation and optimisation) but as factual data externally available in the real world (i.e. data oriented systems for data retrieval and analysis).

Although the present use of the term 'information system', by and large, implies the use of computers, an information system could just as well be implemented manually by searching through coded shelves or files, or mechanically by using partly automated recall equipment. Depending upon the given circumstances, one method of processing will tend to be preferable in terms of efficiency and economy than another. In small practices, manual handling of design data is still favoured, but as the volume of information involved expands, this method soon becomes tedious, prone to error, and time-consuming. While mechanical handling is superior to the manual, the analysis and manipulation of design data is never as efficient as computer processing. When it is well organised, manual and mechanical methods of data processing are still acceptable. Computer processing however, is considered to be significantly superior when:

(1) The amount of information demanded is large.

(2) There are commonly recurring information needs.

(3) Fast access to information is essential.

(4) Complex and accurate manipulation and analysis of information is necessary.

As described in Chapters 1 and 2, there are various types of design information, each with their own individual form, characteristics and particular area of use. Consequently, each requires a different specification and handling procedure: it would be overly ambitious to imagine that a single system could handle all types of design information. Furthermore, the computerisation of information handling and retrieval, often needing to be tailored to the needs of a particular design office, might prove to be inefficient simply because the gathering of raw data and its transcription into machine readable form would take as much or more time as doing it all manually. There is also the time and cost incurred by regular updating of the system. In reality, only a few practices actually require (and can afford) computerised information systems for their design data handling. In short, the cost and effort of establishing such a system for private use will only rarely balance against the benefits subsequently obtained. Consequently, the sharing across professions and industries of useful design information has been emerging in the form of information services - centralised stores of information, usually computerised, from which such information can be provided to their subscribers.

3. TYPES OF INFORMATION SYSTEMS AND SERVICES

Of all existing computer applications in architecture, information systems are probably the least used. This is mainly because their potential has not been properly exploited, typically confining their use to limited areas such as searching for bibliographical references, building product specifications or local housing management records. Thus the extent to which a system can contribute to the entire design process has been so meagre that its uses have never been popularly championed or economically justifiable.

The information systems used in all building related fields may be distinguished on the basis of the areas of use for which they have been developed. The Working Party on Data Co-ordination was established in late 1968 by the National Consultative Council (NCC) of the then UK Ministry of Public Building and Works to initiate a theoretical groundwork for data co-ordination in the construction industry in order to improve the supply of technical information. In its concluding report (1971), it defined three kinds of information system for the construction industry [4]:

(1) **General Information Systems** handling information which is generally applicable to any building project and available to all. For example:

Codes of practice, manufacturers' catalogues, building regulations, research reports, standard methods of measurement.

(2) **Project Information Systems** handling information which is specific to a project, such as:

Client brief, production drawings, conditions of contract, heating calculations, correspondence with project participants, etc.

(3) **Project Management Information Systems** handling information which is specific to an organisation, such as:

Standard office details, cost and output records, construction techniques, and so on.

Later in 1976, the International Council for Building Research Studies and Documentation (CIB) [5] adopted the same breakdown of information systems as a basis for the description and evaluation of current types of information system, but with certain minor name changes. The three categories above became, respectively, product, project, and management information systems. The discussion here, however, will use the original terminology of the NCC.

Many general information systems have been developed commercially, and are widely used, owing their success largely to the increasing efforts put into standardisation of terminology and classification of 'general' information. Their uses have been increasing in line with improved user acceptance. Users of these systems may, in some cases, possess commercially packaged software for their own particular use. Other practices will prefer to have access to larger systems, either through computer bureaux, or directly through viewdata systems (such as British Telecom's Prestel or the French Minitel service), telephone or postal enquiries or visits to organisations operating information services. User enquiries are answered, either directly by the system employed, or by onward referral to other appropriate sources of information. Examples of such services used in various countries are [6, 7, 8, 9]:

Architectural Periodical Index (API) by British Architectural Library, RIBA, UK : Contains literature on architecture and allied arts, construction technology, landscape, planning, etc.

PICA by Property Services Agency (PSA) Library Services, UK : A bibliographic database containing details of journal articles and other literature on construction and architecture.

IBSEDEX by Building Services Research and Information Association (BSRIA), UK : A bibliographic database covering all aspects of the mechanical and electrical services in buildings.

CONTEL sponsored by PSA and compiled by NBA, UK: Construction industry information service on Prestel; a wide range of technical, statutory, cost and product information mainly in summary form.

RIBA VIEWDATA Services (RVS) by RIBA Services Ltd. jointly with AVS Intext, UK : Product and practice data such as building regulations, acts and BSI Standards.

BODIL by Swedish Institute of Building Documentation (BYGGDOK), Stockholm, Sweden : Information on technical, economical and legal aspects of housing, civil engineering, building services, low cost housing in developing countries, etc.

Building Commodity File (BVR) by Swedish Building Centre, Stockholm, Sweden : Product and supplier information.

ERGODATA by Universite Rene Descartes, Paris, France : Anthropometric and ergonomic database for use in the design of products, materials and environments.

ARIANE by ITBTB-CATED, France : Building products and technology.

TED by Saarbrucker Zeitung, Federal Republic of Germany : Invitations to tender for millions of pounds worth of contracts.

JICST by Japan Information Center of Science and Technology, Japan : Literature on civil engineering, architecture and urban planning.

Marshall and Swift Computerised Cost Programs by Marshall and Swift, Los Angeles, USA : Construction costs for nearly all types of buildings, reflecting up-to-date labour and material costs for more than 650 locations in the US and Canada.

NAHB County Database by National Association of Home Builders (NAHB), Washington D.C., USA : Information on housing-related topics for all US countries. Data coverage includes housing starts, building permits, population and personal income.

Orr System of Construction Cost Management by Constech, Inc., DFW Airport, Texas, USA : Data on worldwide construction materials and labour costs.

Vendor Information File (VEND) by Information Handling Services (IHS), Englewood, Colorado, USA : An on-line index containing names, addresses and phone numbers of 26,000 vendors of industrial products. It also contains extensive descriptive information on industrial engineering products.

National Master Specification by Public Works Canada, Master Specification Secretariat, Ottawa, Canada : Canadian master specification system.

CIS by Canadian Construction Information Corp., Ottawa, Canada : Building products, standards, codes, costs, administration, accounting, statistical and project management information.

By contrast, information services for the two other types of information, i.e. project and project management information, have not been developed to anything like the extent of general information services. There are two reasons for this. Firstly, much of the information that would typically be incorporated in either system is of a confidential nature. For example, construction details developed at considerable cost, cost particulars for certain projects, personal or 'off the record' details concerning clients, etc. The second and more important reason is the enormous difficulty presented by standardising the terminology and the many and varied classification systems for these kinds of information currently in use.

Where widespread standardisation has been achieved, public information services have emerged, although these are often restricted to areas such as costing, networks and schedules of previous projects. Few project information services have been developed. Examples are [10, 11, 12, 13, 14]:

Building Cost Information Service (BCIS) by Royal Institution of Chartered Surveyors, Kingston upon Thames, UK : Cost information, e.g. cost indices of tender prices, cost trends in building activity, data on labour and material costs, etc.

Bauobjektdokumentation (BODO) by Informationszentrum RAUM und BAU der Fraunhofer-Gesellschaft (IRB), Stuttgart, W. Germany : The file contains information from the professional literature on the planning and completion of buildings. Basic data on costs, architects, engineers and sites are included. All types of buildings are covered. The database consists of journal articles, monographs, proceedings, thesis and descriptions of buildings.

Canadian Inventory of Historic Building (CIHB) by Environmental Canada, Ottawa, Canada : An inventory of 190,000 buildings (up to 1985) that represents early Canadian architecture. It contains data covering architectural features (number of stories, doors, windows, roof, remodelling, building materials, etc.), present and past uses, etc.

Dodge Construction Potentials Data Bank by McGraw-Hill Information Systems Company, F.W. Dodge Division, New York, USA : Contains statistics on construction, both aggregated and at the individual project level. At its present level, data is available by structure category, ownership, county, number of stories, builder type, framing code and whether new or an alteration.

Architecture and Engineering Performance Information Center by University of Maryland, Architecture and Engineering Performance Information Center, College Park, Maryland, USA : Reports on incidents involving the performance of architecture and engineering projects, e.g. water drainage, masonry disintegration, structural collapse, air pollution.

Inventario del Patrimonio Arquitectonico (IPAA) by Ministerio de Cultura, Madrid, Spain : Contains information on Spanish buildings of architectural interest. It includes a description of each building: its use, location, state of preservation, accessibility, etc.

User access to these services is essentially similar to that for general information services. With few exceptions, project management systems are implemented on a proprietary basis.

The distinction between 'project' and 'project management' information system will rarely be clear-cut, since project information may well become project management information during or after the completion of a project (and vice versa) owing to the cyclic nature of information in its form and usage. Furthermore, project or project management information may become 'general' information after completion of a project.

More usually, project or project management information systems centre around property files. These are then referred to as 'management information systems' and display many of the characteristics of both project and project management information systems (as defined by the Working Party on Data Co-ordination). Their function is to support users in monitoring and controlling the physical conditions and administrative requirements of a scheme, in order that they may effectively carry out their managerial responsibilities. The areas of use are typically property inventory, rent collection and review, tenants details and allocations, valuations, maintenance conditions of properties, repair history and schedules, or office document management. Ordinarily these systems are related to the housing affairs of large organisations, such as national and local authorities, New Town Development Corporations, housing associations or large private developers. They are in fact nearly always proprietary systems and are seldom available for public access. A great number of management information systems have been developed and are used throughout the world. Some examples[1] in the UK are:

CMIS (Land and Property Database) currently used by Calderdale M.B.C.

HOMEREPS (Housing Repairs) currently used by 23 authorities including Tunbridge Wells B.C., Worcester City Council, etc.

PIMS (Property Information Management System) currently used by the SSHA

LAMIS (Local Authority Management Information Systems) currently used by 5 authorities, including Dudley M.D.C., Doncaster M.B.C. and Tameside M.B.C.

4. CRITERIA FOR INFORMATION SYSTEMS FOR PUBLIC SERVICE

The aim in using information systems in architectural design is ultimately to improve both the quality of the design product and the productivity of the architect through improved access to information in both quality and quantity. Various types of general information are now available through information services and at generally acceptable cost. Commercial information services for project and project management information are however, few and far between. Even those which do exist are of limited use to architects, and will only be properly useful on rare occasions. The potential benefits to the design process of these two types of information system have not yet been adequately exploited, even though they may be, at times, more valuable than the general information systems. The difficulty of the standardisation of data categories, the proprietary nature of most systems, and the physically scattered, unorganised nature of the information itself seem to militate against their proper use.

The full value of information is only obtained when every potential beneficiary has easy access to it at an acceptable cost. The communal provision of valuable information must be arranged not just for the purposes of a single section of a profession but for the profession and industry as a whole. To achieve this goal practically, many requirements must be satisfied in the establishment of public information services for architects.

First of all, cost-effectiveness should be of primary concern in the establishment of information services. The initial cost of setting up a computer-based information system is high, although it is in general dependent upon the size and capacity of a data base and its

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1 Although every local authority and New Town Corporation has one or more such systems, their names are often very broadly descriptive such as, property management, property gazetteer, property register, property repair systems, and so on.

peripheral equipment. Operational costs are also high as there will inevitably be a necessity to employ specialist technical staff in many areas, e.g. systems analysis, user programming, computer operations, user liaison, hardware maintenance and systems-level programming. The availability (or otherwise) of (these kinds of) technical specialists should be of prime consideration in choosing the degree of automation of an information system. Apart from considerations of computing equipment and staff, equal weight must be given to the costs to be incurred by the administrative and managerial side of the service, including data handling, staffing, office accommodation and equipment, etc. These various cost factors may increase the cost of the information product beyond those levels expected by individuals relying customarily on manual or, at most, mechanical methods of information processing.

Conventional ways of measuring cost-effectiveness however, are not satisfactory. There are always problems in forecasting demand and in measuring whether the benefits to be obtained would exceed the outgoing costs of such operations, since the benefit of improved information is particularly difficult to quantify.

Apart from simple cost-effectiveness, there are further requirements for a successful implementation of any practical information system designed for public service. Many of these requirements will apply equally to the specification of any computerised application in architecture.

First, the categories of potential user and their needs must be carefully studied prior to the development. It will often be the case that a single system is used by several different types of user, whose priorities in terms of information requirements and use will differ.

Second, the use of an information system should not upset the normal pattern of design. In order to sustain the designer's chain of thought, the system should be readily and quickly accessible and easily operated.

Third, information systems must be continually updated to provide the users with the most recent information: this is one of the most important reasons for using an information system. Furthermore, the system has to be flexible enough to accommodate any newly arising needs of its users.

Fourth, the presentation of information output should be carefully thought out. There will often be greater value in a short letter than in a wordy thesis, or in a simple table rather than in a complex statistical analysis. Simplicity of display, and the reduction of output to a necessary minimum, effectively increase the usefulness of the information produced by the system. In addition, information will be better used if presented in a form in which no further modification is necessary.

Fifth, convenience in accessing the system greatly influences user acceptance, critical to the wide use of a system. The system may be accessed by on-line interaction, personal visits, telephone, postal correspondence, viewdata systems, etc. The choice will depend largely on the socio-economic and technological environment of the region or country in which the service will be implemented.

Sixth, the capabilities of a system must be carefully and precisely pointed out to users so that the service is less likely to be misused, overused or underused. A further advantage to making explicit a system's capability will be the larger perception shown in those users' subsequent opinions on its operation. These opinions can then be considered for further refinements to the system.

Finally, although it is not possible for an information system to supply all of the necessary information for the entire design process, systems should aim to meet a wide range of information needs, thus helping to further justify the initial cost of the system.

CHAPTER FOUR

THE PRINCIPAL PERFORMANCE CRITERIA OF PROJECT INFORMATION SYSTEMS AND THE NATURE OF THE PROPOSED INFORMATION SERVICE

This study concerns the development of a project information retrieval and handling service, one that is substantially different in concept from current services where usage is limited to a few specialised areas and is subsequently of little value to the design process. The service proposed here aims to be of much greater use to the designer throughout the design process by providing him with the *feedback* information currently unavailable, but considered essential for practical decision making in design. This chapter presents an overview of the principal performance criteria of project information services, and sets forth the conceptual background behind the proposed service.

1. THE SIGNIFICANCE OF FEEDBACK IN DESIGN PRACTICE

In the proper sense of the word, 'project information' is a kind of feedback information, providing designers with knowledge of performance and consequences of decisions made in the past. The dictionary definition of 'feedback' reads: "return of part of the output of a system to the input as a means towards improved quality or self-correction of error". Analogously, in architectural design, feedback is a monitoring action comparing actual performance of the built product with the predicted performance of design decisions. This enables corrective action to be taken when prototypical problems arise. Feedback leads to improved performance and should be an integral part of every project [1].

Architects traditionally receive little feedback about buildings in use and do not bother to record it even for buildings they have designed themselves. In fact, feedback is seldom made explicit and tends not to be easily communicated. Thus, useful experience gained from past projects is seldom shared amongst the practice as a whole. In practice, organised feedback is available only to a very few offices maintaining a continuous programme of largely similar work. Amongst these offices, only a few will have established proprietary methods of recording feedback information on their past work. The scope and depth of its coverage tends however, to be idiosyncratic and, to a large extent, limited. With the exception of these few offices, particular types of project are not sufficiently likely to recur in general practice to justify wide scale recording of feedback from previous projects. Practical experience then becomes something designers carry round in their heads, thus incurring the several disadvantages of inaccuracy over time and problematic access for other designers.

By and large, the recording of feedback is seen as a non-productive activity, and therefore wasteful of design time. Even in cases where such activity is undertaken, it is readily abandoned when pressure of work requires. So we are consciously discarding valuable as well as costly lessons from past jobs.

Perhaps surprisingly, the importance, in principle, of utilising feedback from past work has often been emphasised by design theorists and practitioners; even the official advice on the subject is explicit about this. For instance, Part IV of the RIBA Handbook of Architectural Practice and Management stipulates the need for obtaining feedback data on completed buildings as an essential activity for designers. The essential role played by the appraisal of buildings in use needs to be further recognised and emphasised: the only way to effect improvement in the quality of the physical environment is through the appraisal of the performance of buildings subjected to the acid test of day-to-day use. On the basis of such appraisal, performance specifications can be formulated as valid goals for designers of projects of similar character. No one however, has indicated a specific direction for this endeavour; it continues to receive far less attention than, for example, information activity for technical data.

Feedback can be a powerful means of alerting designers to the potential faults of current projects, and of indicating the areas for their improved performance. Ultimately, it can provide better value for building users and accountability for those responsible for design and development.

2. USE OF FEEDBACK IN THE DESIGN PROCESS

The need for feedback is prompted by analogical thought processes, which are an integral part of the thought process as a whole: seeking out sources of relevant feedback information and subsequently incorporating it into thinking ahead. As a point of departure, this is described in the contexts of general problem solving and architectural design.

In problem solving, there exists a series of steps which are largely independent of the particular problem area. The following essential steps are identified:

(1) **Problem identification:** attempts to understand the problem and define the boundaries of the problem area.

(2) **Hypothesis making:** generation of a hypothesis as a possible solution to the problem.

(3) **Hypothesis testing:** testing the hypothesis against original criteria.

There is a further reasoning process taking place concomitantly with each of the above steps - the act of *analogy*, which posits certain likenesses between unlike things.

Drawing analogies is an essential and natural part of every problem-solving activity, through which one broadens one's understanding of problems and their potential solutions. Whilst the compass of useful analogy will vary greatly with the nature of the given problem and other factors, drawing analogies from parallel examples in the wider field of concern can help a designer to identify the practical range of variation of problems and solutions in a given context, and, at the same time, to understand their more general implications and consequences.

It should be noted that in drawing analogies, we often depend not only on our own experience and knowledge but also on that of others. Our dependence on the latter will vary according to personality and circumstances. After the identification of a problem **(problem identification)**, the designer will enquire into whether the requirements of the given brief have been met in past design schemes of his own. However, if his experience of the building type is insufficient, he will need to become familiar with the building type in question. A building type study may range from a brief review of the recent periodical literature to a more careful and formal one consisting of collecting prototypical plans of the building type, sorting them into groups, and deriving from these groups the several basic schemes that have been used to design buildings of the kind in question. If the designer discovers schemes which nearly fit his requirements, he will examine each past solution in terms of its relevance to the problem at hand. He will then be forced to generate a scheme (**hypothesis making**) in the light of these analogical solutions, or in the light of some preconception he may have. These two approaches are, however, usually combined to varying degrees depending upon circumstances. Subsequent appraisal of the scheme (**hypothesis testing**) is carried out according to the criteria established in the problem identification and from the review of past schemes [2].

Design decisions in all problem situations involve an element of conjecture. We normally test our conjectures, or hypotheses, by means of drawing or physically modelling that which is to be produced. Scaled drawings and models are indispensable tools for hypothesis testing but in most cases there is a limit to the precision with which they can make useful predictions. The precise performance of a design will rarely be known before the building has been built and occupied. The divide between what is predicted through modelling and what is finally realised will always exist. Experience can reduce but never completely remove it.

Whereas predicting the eventual performance of a small craft design product before it goes into mass production can be successfully achieved by constructing a full-size mock-up, it is in most cases quite impractical to do this, especially when it comes to the testing of large or expensive design products such as buildings. Present simulation techniques using information technology allow the generation of tentative design solutions and prediction of their performance. But they can show only a very small subset of the total range of design possibilities. Neither they nor physical models can take account of all the influences of the real world on these possibilities.

The principal drawbacks of simulation techniques are worthy of further mention. Design is an activity carried out with necessarily limited resources: designers are neither offered unlimited budgets or unlimited design time. Their task then is to find the best possible solution within the limits imposed upon them. As all designers with any experience in using currently available computer-based simulation or modelling packages will be aware, useful results can only be achieved by spending a great deal of time building up the computer model. Usually, such packages require the operator/designer to specify particular values or series of values related to a number of variable factors - each of these variables may then be explored independently. In practice, the necessarily limited number of variables and their interactions cannot fully reflect the complexities of a real world building and its relation to the environment. Even with the largest programs, incorporating large numbers of variables, the problem remains significant. Furthermore, operator time may become a considerable cost factor, and error and confusion may occur from the sheer complexity of such packages. To illustrate this, with just 10 variables and 10 possible values assignable to each, a total of 10 to the power of 10 possible relations must be analysed and considered. The general consensus amongst designers is that current simulation and modelling techniques may be of some use to the researcher but are of little practical value to themselves.

A more practical and effective way of testing a conjecture is to estimate its potential performance from existing real world embodiments of that conjecture, where the real world examples are seen to be design responses to similar constraints and context. To this extent, factual descriptions of existing similar designs greatly help to suggest to designers those associated design values that have been employed in them.

In architecture, existing buildings show the different ways in which different designers solve design problems and the actual performance of their solutions. For example, with the continual problems of conflict between vehicular and pedestrian circulation, established precedents give us the following examples and the experience of their performance in various contexts: the horizontal separation of the Radburn type layouts; the vertical separation of the Cumbernauld town centre type of layout; the unsegregated mixture of the traditional street; and many others, and of course, local combinations. Analysis of these at both the conceptual and detailed levels can serve as a yardstick for appraisal and as a stimulus for new ideas in any current design process. The limits to feedback information, which are limits of variety, precision and detail, are imposed solely by the extent of one's own knowledge and experience and the accuracy of recall.

3. TYPES OF DESIGN PROBLEM AND THE BENEFITS OF FEEDBACK INFORMATION

The degree of difficulty of a design problem will depend as much upon the experience of the designer as upon the nature of the problem. Design problems may then be categorised as:

(1) Problems of an extremely challenging nature for which the designer has no experience or knowledge of precedent.

(2) Problems relating to the design of a type for which the designer is personally inexperienced, but for which the fundamental concepts are well understood.

(3) Straightforward problems for which considerable experience and understanding is at hand.

We have two sources of feedback design information: one, internal, comprising one's own experience and knowledge; the other, external, derived from the experience of one's colleagues, documented sources and existing schemes themselves.

Our reliance upon external sources will vary greatly with the type of given problem. Of the three types outlined above, one's dependence upon analogical feedback from the external environment will inevitably be the highest in case of (1) followed by (2), and least in the case of (3). This follows the recognition that designers with most experience will have least need for external information resources, and vice versa.

In practice, experienced designers tend to depend less, or not at all, on external sources of analogical feedback, particularly in cases where they feel themselves to be self-sufficient in knowledge and experience. There is a pitfall to this attitude as the IAAS study of 1985 [3] suggests. Designers tend to make use of their previous solutions *without any knowledge of their proven success or failure.* They tend not to recognise the need to look outside for additional information or to consider alternative solutions. There is the risk that they will apply old solutions inappropriately to new circumstances. Sadly, we have a long record of the unfortunate consequences of design decisions based on such ill-informed predictions.

In the case of the supposedly straightforward problem (3), the advantages of a degree of feedback information, however small, should not be overlooked. For certain types of building, there is a vast wealth of established precedents and the general form of the solution may be considered to be well known - housing, for example. Countless housing projects have been designed, built and lived in, and as a result, a huge body of information and design experience has been accumulated. Whilst some designers have little or no experience of housing design, many others have years of practical involvement in the field. It is understood from the outset that a housing project consists of a number of dwelling units grouped in a certain spatial layout; that each dwelling needs to be safely linked to public open space, shopping, schools etc., avoiding conflict with vehicular traffic; that children's playspaces should be located in areas with continuous or regular adult surveillance; that the distance between facing windows should be sufficient to ensure visual privacy; etc. These points are now common knowledge to every designer. However, the difficulty is not necessarily in finding a general solution, but in the choice of parameters which best meet the conflicting requirements in accordance with given criteria.

Solutions to a problem may be numerous. From a single problem given to, for example, 100 designers, no two solutions will be identical.

Many problems can be divided into subproblems, which in turn may be further divided into sub-subproblems, and so on. At the same time these problems and subproblems are so bound up with each other and exhibit such complex patterns of interaction that often we can barely distinguish between them. Thus designers are faced with a variety of possible actions and an uncertainty about the possible consequences of each action. Faced with two simple choices (for example, larger open spaces with high-rise, or smaller open spaces with low-rise), an experienced architect may yet be faced with a considerable dilemma since the seemingly simple decision is closely related to many factors, such as the number of dwellings to be accommodated at ground level, the pattern of building to parking layout, the overall costs, etc. The great number of such cross-evaluations makes the overall design process yet more complex.

There will always be the possibility of finding a better mix of parameters to meet conflicting requirements leading to a better solution. Although most designers firmly believe that their final solution is the best one within the constraints given, they never produce the ultimate solution to a problem. The final solution is merely the last of a series of hypotheses in a continuum tending towards a closer fit between the hypothesis and the problem statement. This matching however, for a variety of reasons, is never one hundred per cent. This is why designing is fundamentally different from those sorts of problems better described as 'puzzles' which have a single deterministic solution or solution set. Thus the usefulness of analogical information for the design process will always exist as long as the potential for better solutions remains.

In practice, with the usual time limitations placed upon design, it is quite impossible for architects to make design decisions on a particularly rational basis, logically derived from a fund of relevant, well researched and properly evaluated feedback information. Given twice the time, they could not do so. However, the equally important reason underlying the insufficient research of such information may lie in a complacency about one's own design ability, the lack of an instinctive exploratory attitude or an inadequate academic or practical training.

4. WAYS OF SEARCHING FOR FEEDBACK INFORMATION AND ASSOCIATED DIFFICULTIES

While not showing great enthusiasm in the search for externally available sources of analogical feedback information, many designers acknowledge that their reviews of the concepts and detailing of existing buildings are an important source of ideas and inspiration. Their reviews of buildings in use may take various forms, from a simple scanning of the most recent periodical to a formal study of a building type.

The review procedure will benefit greatly when the detailed characteristics of existing schemes may be matched to one's current design requirements. In order to carry out a review of buildings *which have been designed to meet a particular set of requirements*, the designer can search for information in two mutually complementary ways [4].

(1) Documented information: searching through books and magazines to discover reports on such buildings.

(2) Site visits: observing buildings at first hand, which the designer happens to know exist.

Many buildings which are considered to be of value to the current design and cultural environments (either by editorial policy or through the establishment of certain awards and prizes) receive extensive documentation in the professional journals to assist readers in their proper interpretation. However, finding *particular* examples of buildings which meet *particular* requirements usually proves to be overly time-consuming. Not only are such reports difficult to locate, but they will commonly not describe the building in sufficient detail to provide information at the level needed to answer particular problems. Furthermore, if a building has not appeared in any of the better known journals, it may be extremely difficult to locate.

The coverage of schemes in popular magazines and monographs is limited in many aspects: in its pictorial information; in the necessary brevity of the physical description of the buildings and the site; in the description of the context or scenario, both of the architect's past history and principal design concerns; and in the particularities of the illustrated project. These publications are mainly concerned with communicating a broad current awareness of the field, focusing mainly on the imagery of buildings.

One of the few exceptions to the above is the *Project Reference File* [5] of the Urban Land Institute in the USA, which is a publication purely for feedback of recent, interesting, innovative and financially successful building schemes of the type most demanded by its subscribers. Four full A4 pages are allocated to the detailed (textual and graphical) description of each scheme, covering the site and its surroundings, planning history, finance and marketing details, and the particular experience gained from the scheme (see Appendix A). There are still certain limitations to this creditable publication: its scheme coverage is small - just 5 schemes per issue and 4 issues a year - and certain aspects of the schemes touched upon are still overly brief, leaving out many details of aesthetic, mechanical and social aspects.

Another rare exception is the *Architects' Journal* (UK), a weekly magazine carrying a monthly 'building study' section complete with detailed cost breakdowns and comment, together with an occasional energy analysis. However, with only twelve such studies a year, the coverage of any particular building type tends not to be sufficiently frequent to allow useful comparisons between the characteristics of past schemes and those of a new brief. The degree of detail contained in the AJ building study section is similar to that for the Project Reference File, but the general criticism outlined above applies equally to both. The section displays certain organisational inconsistencies of format in dealing with separate aspects of buildings. Sometimes, one area of appraisal may become blurred with others resulting in difficulties with comparing the details of one scheme with another.

Nevertheless, the Project Reference File and the Architects' Journal are probably the most important and invaluable sources of building appraisal currently available. Subscribers' acknowledgement of this is regularly demonstrated. According to the AJ's regular readership surveys, for instance, the building study consistently scores very highly. In their latest survey in 1986 [6] it topped the poll against all other features in the magazine.

If their scheme coverage were sufficiently widespread, and systematically organised to give a closer match to designers' requirements, their overall usefulness for the practising designer would undoubtedly be further increased.

For many designers, firsthand experience of design solutions (i.e. simply by visiting the site) is the most potent form of keeping up to date with current design thought. Traditionally, this has been an important part of a university architectural training which continues into professional life.

When faced with practical design problems however, a designer is only likely to discover a small sample of buildings with similar requirements to his own. From a purely practical point of view, the number of buildings he may actually be able to visit will be even smaller. There are also many hidden aspects that one cannot elicit from simple observation.

These two forms of acquiring design awareness, through documentation and through firsthand experience, remain the only two methods currently available to architects.

There are serious shortcomings. In both cases, it tends to be the case that only exceptional buildings of the type currently in fashion get documented or visited, since the published coverage of buildings tends to concentrate on buildings with a strong image, rather than those of a simple, good and practical quality. They are rarely typical instances of solutions to the problems found in day-to-day architectural practice.

Good quality design is achieved not only by a pleasing appearance but by the efficiency of layout, soundness of construction, and reasonable conformity to budget. The making of a decent and attractive environment for people to live and work in has a value outside that of the fashion dictates of architectural aesthetics. We can get equally useful design feedback from plain, ordinary buildings, sometimes even from bad ones, as we can from those which adhere to the principles of the latest fashion; often, we will find the former more informative, particularly in practical terms. However, as mentioned before, locating the relevant ordinary scheme is far more difficult than locating the polemical icon. Again, we cannot help but make considerable use of past experience and past work, but we do so in a grossly inefficient way, thus losing most of the potential benefits.

Useful information on existing buildings cannot yet be properly utilised due, on the one hand, to the scattered and disorganised nature of information itself, and, on the other, to the complete lack of interchange of experience and information in a form widely acceptable to practitioners. Experience gained on past projects is thereby often overlooked, so that the same mistakes tend to be repeated and known good solutions are not reused. The consequences of this are not insignificant. The BRE's investigations of over 510 defective buildings during 1970-74 [7] revealed that 58% of the defects were attributable to faulty design, and subsequently that 90% of design errors arise because of a failure to apply existing knowledge. In the late 1970's, the consequences were found to be equivalent to 3.5 billion pounds a year [8]. For the sake of our future professional performance, it is important, not only to make greater and better use of relevant feedback from past work, but also to ensure that the whole industry benefits across the board.

There is then, a major requirement for the easy retrieval of relevant past work carried out under similar constraints of client brief, budget, site conditions, building technology and materials, building regulations, etc.

5. TYPES OF PROJECT FEEDBACK INFORMATION SYSTEM

In the end, the problem of locating schemes which accurately match one's design requirements remains the major deterrent to making proper use of feedback information. Project information services and systems currently available in the construction industry fail to cope with this problem to a satisfactory extent.

Project feedback information systems may be classified by their approach to the factors shown in Table 1 below.

TABLE 1. Critical Factors concerning Project Information Systems

BUILDING TYPE	ASPECTS COVERAGE	LEVEL OF DETAIL
universal	limited	limited
principal	⋮	⋮
subtype	comprehensive	detailed

Under the category of **building type**, *universal* refers to the entire spectrum of buildings; *principal* refers to a typology of buildings related by function (e.g. housing, libraries, universities or medical buildings); and *subtype* refers to distinct categories of buildings within a principal type (for example: bungalows, terraced houses, flats and maisonettes are all subtypes of the principal type, housing).

Under the general label **aspects coverage**, *limited* signifies coverage of a single aspect of buildings, e.g. social, physical, technological, etc., whereas *comprehensive* signifies coverage of all aspects. Generally, systems will fall somewhere between these two extremes.

In the column **level of detail**, *limited* implies a rather broad categorisation for an aspect of buildings, like a broad breakdown of construction costs into direct costs, overheads, taxes and interests, whereas *detailed* implies, for example, the much finer detail which appears in a Bill of Quantities. This is a continuous rather than a discrete range.

There are many different **building types** or typologies. Each principal building type has many subtypes. The number of subtypes of a principal type can in fact be very large as variations may be made in an almost indefinite number of ways, depending largely on the point of view of the classification of the principal type. For example, housing may be classified into various subtypes according to its form, purpose, method of construction techniques, physical location, etc.

The **aspects coverage** and **level of detail** can only be expressed in relative terms. Building schemes may be appraised or described from a great, even infinite, number of aspects and each of these may in turn be analysed to infinite levels of complexity. Thus it should be noted that the extent of the aspects coverage and level of detail referred to here, e.g. comprehensive or detailed, refer to as many aspects or as detailed a level as we can practicably identify and use in a meaningful way.

Many different kinds of project system are in fact possible from the combination of these three factors. The least complicated will be the category which involves the set of *[limited]* aspects coverage and *[limited]* level of detail. Examples of this sort will usually be seen outside the building design field, for instance, as a property record system for a housing estate used by banks or estate agencies. Most current project information systems centre around the category of [universal] x [limited] x [limited ... detailed], implying that their uses are limited to searching for only specialised aspects of schemes, though sometimes, to very considerable levels of detail. Examples of this kind are historic building databases or building cost information services.

The most difficult and complicated system to develop would involve the type *[comprehensive]* aspects coverage and *[detailed]* level of detail for each of the building type categories, (1) universal, (2) principal and (3) subtype. These have not yet been fully developed but remain those with the greatest potential for the architectural design process. Each category is described below, in terms of both their difficulties of development and their potential benefits for the design process.

(1) *[universal] x [comprehensive] x [detailed]*, involving all building types in every aspect to great level of detail.

This category of project information system would, without doubt, prove most difficult to develop. Its development on a common basis applicable to all building types and comprehensive in all aspects in great detail, whilst not impossible, would certainly pose considerable difficulty since it would require a complicated classification system and extremely complex and lengthy data structures within the computer. In fact, there is no need for all building types to be processed within a single schema. The reason for providing a single standardised schema is to be able to compare the performance of schemes on a common basis. In design practice however, there is little or no need for comparisons between different principal building types. A specific building type (i.e. a subtype) is selected only within the general heading of a principal building type. No one would seriously consider the choice between two or more different principal building types - for example, between a house and a hospital, a church and a car park. Once a specific building type has been determined, further comparison will only be made within the same principal building type. Thus, the concept of a single schema for all building types on a common basis would, in reality, prove inefficient for design practice. Instead, two other types of system should be considered.

(2) *[principal] x [comprehensive] x [detailed]*, involving a principal building type in every aspect to great level of detail.

There will still remain the problems of a complex classification system and lengthy data structures within the computer, though less than for category (1) and more than for

(3). However, its usefulness for the design process will be much greater than category (3) as it can be used by designers, not only to explore the appropriate subtype for a given project, but also, after a subtype has been selected, to compare his or her own tentative design solutions to those contained in the system. In fact, specific subtype selection for a design is, in many cases, not determined until the potential of the many other possible subtypes within one principal type has been considered. This suggests that this category of project information system may cover the whole design process from the very early stage of project formulation to the final stage of scheme design.

(3) *[subtype] x [comprehensive] x [detailed]*, involving a subtype in every aspect to great level of detail.

Of the three categories, this requires the least development effort and avoids many of the possible shortcomings inherent in the other two categories. However, the use of a single system of this kind would be beneficial only after a specific subtype has been selected from various subtypes within one principal building type. Furthermore, the system would prove of no great value even in the later stages of design, when a project involves more than one specific subtype, e.g. a mixed housing development.

The work proposed here involves the development of a project information system of the second category, that is, *[principal] x [comprehensive] x [detailed]*, where the principal building type will be housing. The intention is to support designers involved in housing projects by providing a public information service which will supply them with feedback information derived from buildings in use. Examples of the kind of service proposed here have already proven themselves in certain other professional areas, for example, in legal practice [9]. The proposal will also address various issues as yet unanswered, notably, whether this kind of comprehensive and detailed project information service is technically and organisationally feasible, meeting the necessary professional, financial, institutional and managerial constraints, and whether it would prove acceptable to practising architects in terms of its benefits and cost-effectiveness.

In the next chapter, the kind of housing information service proposed in this study is outlined, together with the ways in which it might be used. Chapter 6 will then clarify the nature of the above-mentioned constraints, consideration of which is essential to the viability of the proposal.

CHAPTER FIVE

THE HOUSING INFORMATION SERVICE (H.I.S.) AND ITS AREAS OF USE

The concept behind the Housing Information Service (HIS for short) is straightforward. The potential benefits of feedback information which may be gained from the analysis and appraisal of buildings in use have not yet been fully or properly exploited. The primary reasons for this result from, on the one hand, the many problems inherent in the research of feedback information, and on the other, our simple indifference to the importance of such information. The HIS proposes to significantly reduce these problems not only for architects, whose particular needs provide the main emphasis here, but also for related groups of practitioners engaged in housing projects.

Housing projects are by their nature diverse and complex. Despite a very considerable pool of knowledge about the process of housing design, it remains unevenly distributed with few commonly accepted or clearly formulated theories about the nature of the relationships existing between the variables comprising a housing scheme. Yet housing is the most common building type encountered in everyday life and the area which absorbs the greatest proportion of building resources. In the UK, for example, more than 10% of the annual Gross National Product is spent and invested on housing development and related business, involving numerous practitioners, construction workers, building product suppliers and consumers [1]. Approximately the same figure applies in Korea. Any system which actively seeks to improve the performance of architects, planners, developers and the like, can only lead to the more efficient use of such enormous resources and, consequently, better value for clients.

Provided that the potential of a detailed and comprehensive project information system for housing is successfully realised, the following benefits would accrue. First, unlike other project information systems, this system will inform the practical decision making process throughout the design and planning stages of a housing project. Second, the system can provide a sound basis for structuring and managing design and constructional feedback information on a completed housing scheme - information which is, in conventional practice, inconsistently managed and profoundly wasteful of valuable storage space. Third, it may also be used for keeping in touch with current developments in the field, and for retrospective research into past and existing schemes.

Its implementation and effectiveness can only be made possible by the use of modern computer based information technology. Both in speed of response and the depth to which the HIS is able to explore relatively detailed aspects of building design, it would exceed anything currently available to practitioners relying on paper or similar media.

On these premises, this chapter is devoted to the performance specification of the proposed HIS with regard to the areas for its use, setting out by identifying its use in the general context of decision making, before continuing with the main concern, that is, with which areas of use the HIS aims to be most beneficial.

1. THE USE OF H.I.S. IN THE DESIGN PROCESS

Drawing analogies from past experience or observations is a common initial step in any decision-making process. However, the extent to which one can do so will be limited by the depth and scope of one's own past experience and by the accuracy of recall. Thus designers may, to varying degrees, come to rely on external sources of analogical feedback in the relevant field, drawing from them clues to possible solutions to the problem in hand. Inevitably, the need for considerable resources of time, money and enthusiasm required to do this properly act as major deterrents to any extensive search for such information. In consideration of this, the HIS is proposed to inform analogical design thinking amongst practitioners involved in housing projects by providing detailed analogical feedback information obtained from the appraisal of existing housing schemes, which might not otherwise be so readily or conveniently available.

The design processes most affected by analogical thought are those found at the outset of a design project, i.e. the briefing and sketch design stages, when the designer is involved with:

(1) Problem identification:

The designer can be helped to identify the general picture of a given design problem by reference to contextually similar schemes and their known problems.

(2) Hypothesis testing:

The designer can be helped to test potential solutions to a given problem by comparing predicted performance against that of existing practical solutions; comparison would be made from a variety of aspects held in the system.

For example, typical instances of the use of HIS in the early design stages may be: to formulate a practical brief to reasonably balance the design requirements against the given budget; to investigate in greater detail the feasibility of a brief within its given constraints; and, to compare alternatives in a general search for solutions at sketch design stage. The system could also be used to find schemes similar to an outline design solution generated independently of any reference to the HIS: this original sketch design could then be modified after examining existing prototypes found through the HIS.

In many cases, the service would provide details of existing schemes, matching closely with the client/designer's requirements. The potential problem must be considered of the client/designer group opting to use the original design, in some slightly modified form, in cases where the resultant saving in design time might be deemed necessary or where the designers, for whatever reason, consider that there is no possible better solution to that presented to them by the system. In either case, it should be noted that raw output from the HIS will not of itself indicate solutions to a given problem. The capabilities of any building feedback information system of a similar nature to the HIS are inevitably limited by the fact that it can only describe reported instances of past designs and their performance. These cannot be expected to represent the whole sum of possible design possibilities to an immediate problem. Rather, the system should be used in a decision supporting role to increase the designer's understanding of the given problem and the general nature of previous solutions, thus enabling him or her to make better design decisions. It aims to reduce the degree of uncertainty against which a decision has to be made, by providing information of a kind otherwise not readily available, and by indicating the likelihood of success attached to some desired outcome.

2. MAJOR CATEGORIES OF USERS AND AREAS OF USE FOR THE H.I.S.

There are potentially many and varied uses of the proposed HIS. Having defined the principal categories of users, some of their respective information needs will be described.

Many of the aspects of past schemes found to be relevant to architects' particular interests will inevitably coincide with those of practitioners in related practices, although the requisite degree of detail will probably differ. For example, the detail required of a cost breakdown by the quantity surveyor will no doubt exceed that of the architect, whilst the detail required of a functional breakdown by the architect will exceed that of the quantity surveyor. However, it is presumed that, should the provision of supplementary detail required by related practitioners (within reasonable boundaries) not go beyond the originally stated intentions, the potential uses for the HIS are further extended to many other areas related to housing development.

Table 1 below illustrates the housing development process, together with the correspondences between groups of domestic construction practitioners and the project development stages where use of the HIS would prove to be of value.

TABLE 1. The Housing Development Process and the Areas of Use for the HIS

Housing Development Process	Areas of HIS Use					
Preparation of the Housing Programme	1	2				
Goal Identification	1	2				
Identification of the Main Policy Choices	1	2				
Generation and Tests of Alternative Strategies	1	2				
Preparation of the Draft Plan	1	2				
Preliminary Evaluation of Potential Sites	1	2				
Land Acquisition						
Initial Design Brief	1	2	3			
Exploratory Design Work			3			
Final Design Brief			3			
Scheme Design			3			
Production and Contract Documents						
Tendering Process				4		
Construction						
Post-analysis of Scheme					5	6

Key
1. For Housing Policy Makers and Planners
2. For Brief Maker (Client, Architect, Quantity Surveyor, Administrator or Contractor)
3. For Architect
4. For Contractor
5. For Research Worker
6. For Public Agency Responsible for the Preparation of Local and/or National Housing Statistics

It should be noted that it is also possible for other professional and non-professional groups to benefit from using the HIS when the nature of their practice extends to the proprietary areas of groups more directly involved. The following subsections describe representative instances where the HIS aims to be of use.

2.1. FOR THE CLIENT AND BRIEF MAKER

The usual design process first involves the preparation of a project brief (a 'building program' in the US), outlining the requirements of the client, from which preliminary sketch plans can be prepared by the architect in order to establish outline siting, space relationships and appearance. The client's brief forms the basis on which all participants of a project will proceed. Thus it should be expressed as clearly and accurately as possible to minimise the risk of any communication failure between participants in a project which could result in difficulties and reduced efficiency at all subsequent stages of the project. In practice however, the brief will frequently contain heavy imbalances: primarily those between the client's stated requirements and the proposed budget.

It is not uncommon for clients to be wholly unfamiliar with the building process. They may have trouble in articulating all their requirements and expectations; there may be little recognition of normal design and construction time schedules; inadequate budget estimates for the services of professional groups; and no appreciation of the many indirect expenses such as tax, insurance, permits, and so on. Accordingly, we may distinguish two types of clients, i.e. the experienced and the naive. Experienced clients are persons or organisations who are aware of the general constraints and implications of their requirements in relation to their available resources. By contrast, the naive client is one who knows little or nothing of building and building design. There is often very real and unavoidable confusion for a naive client in exploring and reconciling his or her conflicting needs. Even experienced clients will not be completely free from this. The effectiveness of communication between brief maker and client will undoubtedly vary greatly according to the experience, or otherwise, of both parties.

The brief maker acts as an intermediary between the client and other professionals, which requires him to have some knowledge of other professions. His first task, for which he requires considerable assistance from the client, is to make an accurate diagnosis of the client's problem, by advising what effects may be achieved by changes in the character or detail of the clients stated requirements and corresponding investment. He, whether architect, quantity surveyor, administrator, developer or a subgroup of the client group itself, must be able to show the client (particularly the naive client) a comprehensive appraisal of the various prospects and constraints involved. This is essential to develop a greater awareness of what is, and what is not, practicable in terms of construction on the given site. However, in practice, there is seldom a complete exploration of all the client's needs and of the limitations that must be accepted - nor will the client be sufficiently informed of all the possible means of meeting his needs.

There are two kinds of commonly recurring difficulty which brief makers encounter in communication with their clients.

The first concerns the speed with which questions concerning the possible consequences of varying client requirements can be answered. Without detailed analysis of the complex interplay of many factors and constraints, some of them local to the particular project, a professional judgement concerning, say, the environmental performance of a building against entailed cost, could not immediately be given. In many cases, some considerable time would be needed for the brief maker to examine the proposals and their consequences, possibly in consultation with other professionals, and possibly with reference to particular sources of information. Clearly, in such cases, a spontaneous answer would be impossible to give.

The second difficulty concerns effectiveness of communication. The client and brief maker often have different priorities and perceptions of what should and can be achieved. Thus open and precise communication between them is essential to reduce their differences. Verbal communication is not always very effective, especially when a client is not particularly acquainted with building concepts or terminology. In such circumstances, the constructional consequences of a client's requirements will be better understood (by the client) if presented in terms of a comparison with examples of existing buildings. If a suitable example is well known to the client, communication will be further improved. If not, pictures and drawings of the comparative examples will certainly improve the client's overall understanding by giving him a confident mental image of the proposed building. However, this is the ideal, and rarely takes place in practice. Generally, many of the client's needs are not made explicit until a sketch plan emerges. These often then nullify the plan and make a completely new plan unavoidable.

Solutions to the problem are not to be found by improvements to one side only. They require an interactive approach by both brief maker and client. Given greater understanding and tolerance by the brief maker of the client's confusion, and some tools for helping him, the task of preparing a brief might be done more expeditiously and more effectively. It is conceived that the HIS will help to reduce these difficulties, through its capacity to process structured descriptive information with speed, and by presenting pictorial information on existing housing schemes with similar requirements. Thus the service will contribute to the eventual production of a more realistic and practicable brief in which the priorities of clients are more explicitly expressed. It will help clients, not only to conceptualise their requirements in building terms, but also to identify the most appropriate practitioners or organisations to approach in order to satisfy these requirements.

2.2. FOR HOUSING POLICY MAKERS AND PLANNERS

This section describes two of the problem areas for housing policy makers and planners to which the proposed HIS, on the assumption of its wide scale operation and with wide scheme coverage, can make a significant contribution.

The first problem area in which the system aims to be useful is that of information activity. Before any policy or proposal concerning housing affairs can be established, all requisite information must be collected and analysed to form the basis for the ensuing decision making process. Much of this material is obtained by reference to standard statistical data sources such as the population census and the national dwellings and housing survey. Whilst such statistical information has quite clear-cut uses, the scope and detail provided by its analysis is frequently limited by the tendency to cover only the socio-economic aspects of housing. This tendency is common internationally. Other kinds of information commonly required by housing policy makers and planners are: local physical and geographical characteristics; the availability of resources; general housing fabric conditions; traffic patterns; capacities of existing utilities (e.g. water mains, sewerage, electricity); etc. The planner or policy maker has then also to rely on his own local documentation and on field surveys commissioned as and when the need arises. In these cases, such time-consuming activities make the time available for the decision-making process significantly shorter. A large proportion of the overall effort goes into seeking out possible sources of data, and putting it into a usable form. The time consumed using manual methods, both in basic storage and simple manipulation, can severely restrict both the quantity and quality of information brought to bear on each planning exercise or decision [2].

The second problem area is predictive modelling. The planning process for a housing development starts with decisions primarily concerned with costs, population densities, and the area and location of the particular site. Subsequently, decisions will be made concerning the types, forms and sizes of housing, the construction period, and so forth (although policy decisions on some factors might have been made beforehand). The planner's task is ultimately to deal with a complex set of interrelated factors and to assign to each a mutually consistent set of values or value ranges. In making and examining housing policy in general, or development proposals in particular, one needs a clear understanding of the expected impact of policy or proposals in respect of each of the issues examined. Where options are presented, an exposition is required of the comparative performance of each in relation to the identified issues or factors. Quantitative modelling techniques are usually integrated into this process to predict what the policies and proposals will bring about.

Quantitative models, with their explicit and quantified assumptions, can quickly provide superior bases for monitoring the consequences of adopting different key factors which may in practice be difficult to assume with any confidence. However, for all their proven excellence in certain well defined areas, there are definite limits to their application. These arise particularly when there are a considerable number of independent issues to be correlated, and when there is incomplete information for the model. Furthermore, there is always the possibility of unforeseen factors arising to upset predictions. These weaknesses are inherent in all models: the simplified version of reality not taking sufficient account of the complexities of the real world.

Each of the two problems discussed can be more effectively dealt with by introducing systematic information handling into general practice. First, by providing up-to-date, comprehensive and detailed information on housing (which is otherwise not readily available) at regional and/or national levels, the HIS will save considerable resources through minimising the duplication of information activities by housing policy makers, planners and administrators. Second, the use of the HIS for modelling, with respect to analogical problem solving, will offer considerable opportunities for improvement by providing the real world performance of past housing policies: the HIS will enable housing policy makers and planners, not only to efficiently monitor the performance of current housing policies, but also to properly evaluate the likely effects of changes in policy. This will result in the earlier establishment of policy decisions, and their more effective relationship to the formulation of housing programmes.

2.3. FOR THE CONTRACTOR

The fundamental decision of whether or not to tender is often unduly rushed, resulting in the significant possibility of a contractor suffering considerable financial loss. In the tendering process, a contractor is supplied with written descriptions for a project (e.g. bills of quantities, schedules and specifications of works) along with production drawings. The time given for a contractor to study a tender in detail may vary from one week to several months, depending on the overall scale and general nature of the project. This time is further shortened by the simple need for final presentation of the tender documentation.

In this limited time period, there are a great many factors for a contractor to consider. He has to evaluate his current workload, the availability of capital, human and material/plant resources, and the general market conditions, together with the various details of the new project itself. These details will include: type and location of the job; size, nature and value of the project; terms and conditions of the contract; relevant knowledge concerning the client and professional groups involved; and any knowledge he may have about rival contractors known to be tendering for the same work. He has to study the given information with enough care to be able to assert the feasibility of the eventual tender price and tender period. Moreover, he is required to do this in a time period far shorter than that taken by the architect (and allied professions) to formulate the design concept [3]. The best of contractors, employing highly skilled staff, and familiar with the particular type of project, cannot be expected to do this accurately without at least some form of predictive inaccuracies occurring.

Inevitably, the contractor will tend to rely heavily on his past experience and office records of similar types of project. Frequently, it is this kind of experience which proves most significant at the fundamental level of decision making, that is, whether or not actually to tender. The greater the experience possessed by the contractor, the better he will accurately predict the profitability of a particular tender. However, there will always be limitations to this procedure, limitations which will be further highlighted when projects arise outside the contractor's particular expertise in terms of their scale, building type or technical requirements. To this extent, the HIS can be seen to be of considerable use in any review of a range of building types which may be unfamiliar to the contractor. It will help the contractor to reach a better decision for a tender by providing comparative analysis of similar schemes in terms of constructional and continually updated financial detail.

2.4. FOR RESEARCH WORKERS AND PUBLIC AGENCIES RESPONSIBLE FOR HOUSING STATISTICS

Research workers spend a large proportion of their time and effort searching for possible sources of data relevant to their interests. The value of any data will depend on the degree to which it tests the validity, or otherwise, of a researcher's hypothesis.

In any housing related research, schemes of interest have firstly to be be located and their substance understood before any hypothesis may be explored. For any research which seeks to relate the material attributes of housing schemes to another area of interest, e.g. socio-economic or psychological phenomena, the HIS may be used as both a primary source of information, and as a reference source through which further sources may be identified. It may be of further use in statistical analysis, for example, in the correlation of data already held in the system with findings from the researcher's own studies. Typical lines of enquiry might be: the relation (if any) between tower block housing schemes and recorded cases of crime and vandalism; the significance of this when compared to similar studies of traditional terraced housing; the degree to which layout type influences social interaction between neighbours, and so forth. For these types of questions, the HIS may be used to provide, quickly and precisely, a list of suitable housing schemes exhibiting the required attributes for the chosen study.

Public agencies responsible for the preparation of housing statistics may save a great deal of effort by using the HIS, though again this is based on an assumption that the HIS operates on an extensive scale. Housing statistics are only finally prepared after many different stages of data collection and processing, with each stage incurring considerable manpower and cost. Nevertheless, the statistics available at present allow for only partial descriptions of contemporary housing. In most cases, qualitative descriptions of housing are lacking. It is envisaged however, that for data on many aspects of housing the HIS will obviate much of the usual groundwork involved in their preparation and provide a broader and more accurate coverage of the available data. This would be achieved firstly by the continual addition to the HIS of details relating to housing schemes (new build and refurbishment) immediately upon their completion; and secondly, by the ability of the HIS to manipulate such data with speed and in a variety of formats compatible with the requirements of any statistical analysis.

2.5. OTHER AREAS OF USE

The areas of potential use for the proposed HIS so far described are by no means complete. There will be many other areas and circumstances in which the system may prove to be of benefit. For example, it could be used for students in their academic training, for prospective house purchasers (either on the suitability of a particular kind of housing or in choosing the right design team for a new house), and for housing related organisations and publishing houses in managing their housing information. However, it is deemed sufficient here to outline the major schematic conception on which the goals and associated structure of the HIS are based.

To cater for the wider information needs of all other potential groups of housing related practitioners, the extent and depth of information suggested here will have to be supplemented by related data items aimed at the particular needs of these other users. Such supplementary data items should also serve as a major source for onward referral of enquiries particular to various types of user.

A small scale experimental demonstration of the proposed HIS will be described in Part Three, which is made upon the basis of the intended goals of the service described in this chapter.

PART TWO

IMPLEMENTATION OF THE HOUSING INFORMATION SERVICE

CHAPTER SIX

PRACTICAL CONSIDERATIONS OF IMPLEMENTATION AND DATA COVERAGE

The previous chapter has described the overall goal of this study, which is to develop a detailed and comprehensive housing project information service. This was discussed in the context of the needs and requirements of such a service from the point of view of many different user groups. These broad requirements will, however, be necessarily tempered by considerations of the overall scope of data coverage - the practicalities of its collection, storage and dissemination - and the characteristics of potential implementing organisations.

The first half of this chapter focuses on those primary factors which critically influence decisions on the practicable scope of data coverage, namely: the relevant criteria of schemes to be processed; the overall volume of data; data properties; and methods of data collection. The second half will be concerned with the organisational and technical factors critical to the data coverage and successful implementation of the proposed service, which are: the kinds of organisation considered capable of implementing the HIS; the information resources available to them; any planned phasing of the implementation; implementation at international scale; and finally, the complex issue of copyright over design data.

These factors cannot be treated individually, as consideration of one will tend to bear upon each of the others. However, inasmuch as they may be separated, they will be elaborated under individual headings.

1. PRELIMINARY CONCERNS OF DATA COVERAGE

1.1. SCHEME COVERAGE

The possibilities exist for the HIS to operate at regional, national, or even an international scale. Operating the service on a large scale will undoubtedly maximise the potential benefits gained from collective design and planning experience. With the appropriate implementation, this collective experience can be most effectively shared by designers and other practitioners concerned with housing.

The first concern is related to the strategic criteria of housing schemes to be involved in the service. As there are no two identical programmes for housing schemes, there can never be a scheme on file which exactly matches all the requirements of some new programme, or which exactly matches a user's complete list of information requirements. The operating philosophy will be simply to meet such requirements as closely as possible. It is thus obvious, that the more schemes the system contains, the better the chance of a closer match with a user's requirements. The advantages of having a wide variety of schemes in a centrally located data bank is equally clear. Valid identification of the practical consequences of a tentative design solution becomes much easier when reference can be made to a large number of similar schemes. Useful comparisons can then be made between solutions aimed at a single prototypical problem. Particularly for planning and statistical purposes, the HIS may be of little value unless a significantly large number of housing schemes pertaining to a particular aspect of enquiry are provided.

However, considering the number of housing schemes already in existence and the number of projects further under construction each year, the collection of data, by whatever methods, will certainly represent an extremely time-consuming and costly operation. It becomes a greater burden where a considerable number of data items must be collected for each scheme.

The collection and handling of such large volumes of data immediately from the outset of the service would impose a heavy burden on the implementing organisation. A better strategy would be to initiate the service with a limited amount of data and later to carry out its gradual accumulation by phasing the implementation of the service. This would allow time for reconsidering the initial data collection and service strategy, taking into account any comments from the information users.

It will be inevitable therefore, that the housing schemes represented in the system will, in the initial stages at least, be selected according to some imposed criteria. These criteria may be: the type of user group, type of housing, geographical area, etc. The choice of criteria will also be affected by the method chosen for phasing the implementation. It may be that the best choice of criteria is guided by their estimated usefulness to the information needs of architects and, if so, the prime criteria would quite probably become that of the quality of housing. This is, of course, a relative term - appreciation of the quality of a built product will differ from person to person, each placing their individual emphasis on different aspects and details. In an effort to narrow such divergences of interpretation, we would again inevitably have to rely on the definition of "good quality" used in Chapter 4, whilst still admitting to the looseness of the term.

1.2. VOLUME OF DATA

Housing as a physical entity. A housing scheme comprises a multitude of material components, each in turn possessing various attributes. Components may range from the very small (e.g. doorknobs and mailboxes) to the very large (e.g. playgrounds and housing blocks), each having their own particular attributes such as area, size, form, colour, texture, endurance, cost and so forth. All are intricately interrelated and, in their aggregation, characterise each scheme uniquely. There will be no two identical housing schemes.

Housing as a social entity. A housing scheme is characterised by the quality of social interaction and by the quality of life within it. This is far more elusive to describe than the physical aspect of housing.

The size of a computer file will depend largely on the degree of detail accorded to the description of each scheme. A number of estimates of the amount of computer storage required for a typical project database have been made. For example, Bolt, Beranek and Newman [1] estimated that a computer-stored description for a 188-bed hospital (for automated checking of building codes only) would require around 40,000 to 50,000 characters. A rough reckoning by Jackson [2] estimated a minimum of 10,000,000 characters or bytes of data for the design description of a 20-storey building (with no particular types or sizes specified, and without including information on product data, master specification, or encoding of design drawings). Eastman et al.[3] estimated a typical 10-storey office building of about 120,000 sq.ft. to comprise about 150,000 parts requiring separate description -

at even ten characters per part, this amounts to some 1,500,000 characters. These figures will be significantly increased where the scope of data extends beyond the mere physical description of a building, to include relevant information from say, the behavioural sciences, as it bears upon the architectural design.

Although such highly detailed housing information systems (processing every minute characteristic detail of housing schemes) are technologically possible, real systems must inevitably, from the outset, be justifiable in terms of their cost to benefit ratio. That is: whether there is an apparent or foreseeable need for such a detailed system; whether there is sufficient capital, technology, time and manpower available to develop, operate and update such a system; and ultimately whether the needs of the first will outweigh the monetary and human efforts of the second. Any lack of consideration for the practical economic aspects could easily lead to early abandonment of the project.

1.3. DATA PROPERTIES

The collection of enormous quantities of data for the fine-grain description of housing is clearly impracticable. Similarly, the processing of data typically requiring considerable effort of data transcription and entry, and subsequent error checking, will be costly, time-consuming and tedious - going a long way to cancel out the benefits otherwise gained by the establishment of a computerised information handling system. Thus it becomes necessary to question the ontological properties of raw data which a system is to process. Particular attention must be focused on the following:

(1) Is the data difficult or costly to obtain? (data acquisition)

(2) Is the available data in a form suitable for easy computer input, or will it need costly translation? (data translation)

(3) Are the values of data static over time? (data stability)

Obtaining access to data is of the utmost importance - the amount of time and effort involved therein will depend largely upon the sources of that data and the degree of difficulty of acquiring data from them. Information on a housing scheme would be drawn from its various participants (i.e. client, architect, quantity surveyer, contractor, residents of the scheme, and those involved with its management), from inspection of the scheme as it stands, and from any published information concerning it. Each source will most likely yield useful but fragmentary information. These fragments have then to be collated to give a comprehensive description of each scheme. But finding and maintaining contact with these various sources will inevitably place a heavy burden on the available resources of time and money. In reality, it becomes impossible to tap all available sources. Thus, the most practical method for data collection will be to limit information sources to those yielding large quantities of useful information with relative ease, and at relatively low cost.

The cost of data collection is critical to the realisation of a computerised information system. By way of example, the Barbour Index, one of the most commonly used product information sources in the UK, had to give up its original intention to set up a computerised information system after an experimental attempt in 1972, because of the uncertainty in guaranteeing its prospective use to justify the high cost of data collection [4]. This cost will be largely dependent on the methods chosen for data collection and on the co-operation of information sources (which will be described in detail in the next section).

Just as some types of data require more time and effort to collect, so others require more in the way of processing. Required information may be obtained in the form of written documents, tables, drawings or verbal communication. It may be in a form readily usable for computer processing, thus ensuring minimal costs of data translation, but in many cases it will come in a form necessitating laborious manipulation of the raw data. For example, extracting data, such as building materials used in construction, from schedules or specifications is generally a simple matter of transcribing the presented text and numerical quantities into an appropriate data input form; whereas extracting data from design drawings, area measurements for a complex site plan for example, presents a considerably harder task.

Again, while some data may be relatively static over long periods of time, others may not. Typically, building structure and geometrical configuration will not alter over the life span of a building, whilst other aspects, such as environmental amenity or user satisfaction with the scheme, may vary greatly from year to year. Generally, the information system will function more efficiently where fewer changes have to be made to data elements over time. The more a database contains temporally variable data, the harder it is to maintain accuracy within the database. Furthermore, frequent changes made to data content will necessitate considerable expenditure which could, in some cases, eventually jeopardise the longevity of an information system. A case in point: a database set up in 1965 by the

South-Eastern Regional Hospital Board in Scotland, consisting of a complete and priced list of the equipment required in about 1,200 different types of room found in medical buildings, had fallen into disuse by the early 1970's due to the impracticability of keeping the information up to date [5].

Being intrinsically non-static, qualitative data (such as user satisfaction with a scheme) is unlikely to be measured easily and cheaply. The particular problems associated with the handling of qualitative data may be categorised as:

(1) Highly subjective methods of measurement and appraisal

(2) Differing results for the same observation arising from temporal and circumstantial variations

(3) The necessity for extensive field appraisal by means of direct observation, questionnaires and interviews, demanding considerable human efforts and consequent costs

Even where its collection is seen to be feasible, the processing of qualitative information, for a wide scale service, will frequently attract a degree of controversy. In other words, the application of results from social surveys to new design projects will invariably be problematic. User satisfaction, for example, is likely to vary over time - it tends usually to be most favourable when users first move in, and declines as they begin to appreciate the real defects of their new living environment. This is also affected by the constant demand for better living standards. Moreover, there are no widely recognised conventions for its measurement. Notwithstanding these various problems, the inclusion of certain qualitative data for the HIS is unavoidable, even though its continuous updating may be required.

Apart from the volatile nature of survey results with respect to time, there is also a problem with most current surveys of a qualitative orientation, since they tend to simplify the complexity of interaction between human beings, their environment (natural and man-made) and events to simple binary choices - yes/no, like/dislike, or similar.

User responses can rarely be explained by simple and explicit causes. Indeed, the relation between recorded user response and the potential for corrective action is still a subject much in need of further research. To take a simple example where, say, users are dissatisfied with the heating of their housing: in most cases, this will not be explained by any one simple defect, rather, it will be a complex interaction of a multitude of factors such as: human metabolism; boiler size; distribution and material of pipes; number, type and location of heat emitters; plan form; U value of building materials used; size, location and areas of windows; climatic factors; etc. This is why the results of social surveys seldom come in a readily usable format, usable that is, for practising designers. The bearing of some factors upon overall performance may be reasonably assessed by experienced designers by collating appropriate factual information, including drawings. Nevertheless, this information will, in many cases, have to be available in great detail and accuracy: superficial descriptions are rarely of use or interest to working designers, however attractive they may look in the glossy magazines.

1.4. METHODS OF DATA COLLECTION

Linked closely to data availability and accessibility, the method for collecting data must also be taken carefully into consideration. There are four principal means of collecting data: by telephone, by post, by personal visits, and by electronic data transfer from remote data sources. Collecting data by making telephone enquiries alone is generally considered inadequate. It may however, be used to complement other means of data collection. House to house visits may not be very popular, and will certainly be expensive, especially where many geographically remote sources must be visited. But they do usually assure complete coverage of the required information. Associated Building Industries (ABI) in Beckenham, England, specialises in this approach. It is a commercial firm supplying computer-based information on new construction projects, e.g. project type, clients and practitioners involved, tender information and so on. They employ some 30 part-time regional researchers who each maintain their own information sources. These researchers record data in a prescribed format and report to the central office [6]. This costly data collection is imperative for ABI since quickly available information is critical to their subscribers if they are to sell their professional services and products. Of course, the subscription cost is high enough to justify the expensive data collection. In this way, data coverage is greater and collection time greatly reduced, when compared to similar operations relying upon postal replies to information queries.

Mailing is, however, still the most popular and economic method. Typical is the case of McGraw-Hill's Dodge Building Cost Services in the USA, a part of the Dodge construction contract reporting operation. As soon as a contract award becomes known, the company mails a questionnaire to the project architect in order to collect basic information on the building, e.g. award cost, floor area, outline specifications and some other detail [7]. A high level of co-operation from the responding sources is evidently critical to this type of information collection. There are, however, ways in which this co-operation may be secured. For example, Building Cost Information Service (BCIS) of the Royal Institution of Chartered Surveyors (RICS) in the UK succeeds in collecting information from quantity surveyors by supplying information back to them. Cost information on projects, where the measuring work has been done by a member quantity surveyor, is entered (by the QS) on a regular Standard Form of Cost Analysis and mailed to the BCIS. Alternatively, the information may be input directly into a computer, and sent down the telephone lines [8].

Electronic data transfer is the most recent means of data collection from remote data sources; it is much faster and more efficient than earlier methods. The medium of transfer may be telex, facsimile or computer-based message systems. This requires the prospective data sources to possess the necessary terminals and to be connected to the data network used by the HIS. It also requires the highest level of co-operation from data sources and may be possible only where a clear transaction is made between the parties involved. This may be by way of the free reciprocal sharing of data, or by monetary contract. An example is the Architecture Engineering Performance Information Center (AEPIC) at the University of Maryland in the USA, concerned mainly with information on instances of failure in buildings and civil engineering works [9]. It receives data on claims concerning such works through on-line data connection to insurance companies, and contributing members are given free access to the system.

Data collection methods so greatly affect overall data coverage, and ultimately the essential characteristics of an information service, that it is fundamentally important to choose the most appropriate of these methods to achieve the desired end.

2. TYPES OF IMPLEMENTING ORGANISATION: ORGANISATIONAL AND TECHNICAL CONCERNS

Aside from the costs of data collection, an information system of the kind discussed here would still be expensive and complex. Thus, the question becomes one of maximising potential (information) returns against incurred costs of data acquisition, storage, processing, and dissemination. Possible answers will only result from a careful consideration of the implementation strategy.

Implementation strategies, and their projected performance, will undoubtedly vary greatly from one implementation body to another; each strategy will have a very considerable impact upon the scope of data to be covered in the service. Given the known difficulties of data collection, it is highly recommended that the implementing organisation be one explicitly concerned with housing affairs and with handling information on housing schemes. This means that the candidate organisation should have ready access to individual designers or to the formal documents, records, and attendant drawings of individual projects (as submitted by clients or their representatives to local authorities or professional or institutional organisations). Readily secured access to such data sources can significantly reduce the necessary effort of data collection to a practical minimum.

2.1. TWO CATEGORIES OF IMPLEMENTING ORGANISATION

In practice, the following two categories of implementing organisation emerge:

(1) Central governmental authorities and agencies, being concerned with the programming, development and management of housing, and in close liaison with the planning, technical services, and other housing related departments of local authorities.

(2) Non-governmental organisations, being closely associated with housing affairs and/or perhaps already offering an information service to practitioners involved in housing development.

Organisations do exist which fall into these two categories, with different names and varying characteristics from one country to another, or even from region to region. In order to illustrate the nature of the first category organisations (central government agencies, as described above), it is useful to look at the way in which planning and building applications are processed, and through which particular channels they pass. In the discussion of organisations eligible for the HIS implementation, those from the UK are given. Readers from other countries should easily be able to draw parallels with those described here.

In the UK, the planning department of the local authority concerned is the first to encounter a new housing project, followed shortly by the corresponding technical services department.

The applicant is required to obtain two separate permissions[1] : planning and building regulations.

Upon issue of these permissions, certain data are extracted and reported for record purposes to one of the central governmental agencies (the Scottish Development Department, Welsh Office or Department of the Environment in the case of the UK), either directly, or via the county or regional council. This data becomes the basis for overall housing and construction statistics. A similar procedure is followed for any application for an amendment to an existing permit, and for certificates of completion.

Finally, the material is archived for the legally prescribed minimum period of time, sometimes even permanently.

Public sector housing departments also keep records, including drawings, of public housing projects, commonly storing this information on centrally located computers. A local housing department deals mostly with administrative information concerning its council housing (e.g. tenants' details, allocations, rents, rates and maintenance programming) for which it has responsibility. It deals only with council housing, but follows identical procedures to the planning and technical services departments in reporting the current state of housing conditions to centralised governmental agencies.

2.1.1. CENTRAL GOVERNMENT AUTHORITIES AND AGENCIES

This discussion leads us to the central interest here, that is, central governmental agencies. These may be divided into three principal subcategories.

Firstly, those authorities at highest level with respect to the planning, technical services and housing departments of district and borough councils, i.e. Housing and Construction of the DoE, Planning and Housing of the SDD or Housing and Urban Affairs of the DoE for Northern Ireland.

Secondly, bodies concerned particularly with housing, e.g. the National Housing Consortia which compiles and publishes information in order to alert the relevant authorities to

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1 This is not strictly typical. The UK is one of the few countries to require two separate permits, most countries requiring just a single building permit, the granting of which implies both planning permission and building consent.

the experience of others in the field, and to related research.

Thirdly, an inter-authority body concerned with promoting the common interest and facilitating the exchange of information, thereby supporting the technical and administrative services of the local authorities concerned. One example of an organisation in this sub-category is LAMSAC which provides special services and advice (especially on computing) to the 521 local authorities in the U.K. It is managed by a board of elected members from (and is responsible to) the Association of County Councils, the Association of District Councils and the Association of Metropolitan Authorities. It is currently expanding its services to non-governmental organisations and individuals [10].

Still in the public sector, there are government sponsored house-builders such as the Scottish Special Housing Association (SSHA), the New Town Development Corporations (all of which are administered by the Commission for New Towns), and the Housing Corporation (which is responsible for registering, supervising and funding the many non-profit making housing associations around the country). These organisations maintain detailed records of the housing projects in which they have been involved, either as developers or administrators. Many of these records are stored in computers. Even if they do not prove to be suitable candidates for the implementation organisation, these bodies must be considered as excellent sources of data for the HIS.

If the HIS is to be realised within the public sector, then complete coverage of housing schemes across the region or nation could be obtained. However, even where co-operation from data sources such as the local authorities or SSHA can be assured, the methods for transferral of data from them may be troublesome and laborious - whether it is in some prescribed data format, or in its original form as filed documents. There are, for instance, some 458 district level authorities in England, Wales and Scotland, excluding London. A possible approach would be to seek the establishment of a common fund of data - a centralised clearing centre - through which each local authority would store its own data and thereby share that data among inter- or intra-authority departments. This central fund of housing data might be arranged to become a part of an overall comprehensive regional or national data system such as the proposed Swedish national information system [11]. In such cases, compromises on issues of various interest must be made, such as on data co-ordination; unification of emphasis on data items and their accompanying management; and methods of data supply and exchange. One further benefit of such a centralised information system might be the avoidance of task duplication by related departments within an authority and between authorities, which alone would justify the establishment of a central data bank for housing information.

2.1.2. NON-GOVERNMENTAL ORGANISATIONS

There exist in the non-government sector certain organisations which must also be considered as potential candidates for HIS implementation.

The National House-Building Council (NHBC) is a non-profit making body aimed at safeguarding house buyers against constructional defects by issuing ten year insurance cover on new homes coming within their scheme. Its aim is to raise standards in house building by requiring all NHBC-registered builders in the private sector to meet its own rigorous specifications for construction practice and materials. Registered builders are required to submit their building proposals to the NHBC's examination, prior to any submission of planning or building regulation application. (The contents of submissions are in fact quite similar to those of planning and building applications [12].) The NHBC's concern is limited to private sector house building, but this still represents a considerable majority of domestic construction starts in the UK, particularly in those areas where public sector housing has been severely curtailed in recent years. It provides various information services for its members, although the scope of information covered is somewhat limited. It also prepares private house building statistics on a quarterly basis, which include: the number of dwelling starts and completions; house types and construction processes of new dwellings; size of building firms; and a buyers' (ability) index.

Another example drawn from the private sector is the National Federation of Housing Associations (NFHA), which maintains a close liaison between governmental departments concerned with housing. It has at present some 2,000 affiliated housing associations and societies, but limits its concern strictly to projects undertaken by housing associations.

The professional institutions present yet further possibilities. Although it is not the case in the UK, the professional architectural institutions in some countries, e.g. Korea or Taiwan, examine building applications before a formal application is filed with the local authority. They also prepare regular statistical analyses of buildings examined. Whilst the Royal Institute of British Architects (RIBA) has not been involved in such examinations, its candidacy for possible implementation of the HIS remains secure in consideration of its role as the established channel of communication between architects. Amongst other professional institutions, the RICS stands out for having undertaken an information service on a reciprocal basis with a small group of member quantity surveyors.

The information coverage to be secured by one of the above non-governmental organisations might well be sufficient for the needs of brief makers, architects, quantity surveyors and contractors. However for the planner and social scientist, or for statistical purposes, a broader coverage, requiring the inclusion of public sector housing, may be desirable. This could only be obtained by operating jointly with, or with the help of, those organisations which deal with housing information in the public sector. It becomes clear that very similar compromises on issues of conflicting interest (as mentioned above, in the case of public sector implementation) must be made.

Apart from these professional bodies (whose principal motives are not necessarily financial), there are a number of private organisations which may be considered as candidates. Building information services, e.g. ABI, Glenigan or Contract Leads in the UK, or building related periodical services, e.g. 'Architectural Design', 'Architect', or the 'Architects' Journal', fall into this category. Subscription fees to private building information services are currently quite high: for example, ABI charges an annual fee of £1,175 (based on the 1986 figure) for national coverage of information on new construction works. This high fee is justified where fast access to information is essential to potential building contracts or product sales. The information of the kind proposed here, however, will not attract such a degree of demand; furthermore, the success of the proposed service will depend largely on keeping information charges to the minimum. Thus, the suitability of such organisations is to some extent lessened by financial concerns.

Traditional publishing houses are considered to be more eligible than those services mentioned above, in view of their accumulated knowledge and experience in the field and the established channels of communication with designers through the distribution network of their own publications. However, this assumption may not hold true for a large scale service for which the extent of potential subscription might not counterbalance the initial financial commitment to data collection and implementation of the service. Nonetheless, initiation of the service with schemes, selected in accordance with their appeal to the journal readership, would be a viable proposition which may be quickly implemented. The system may also be of benefit to the publishing house itself, in the routine office management of its own housing information.

The implementing organisation may be one of three possible kinds: a completely new organisation; a new section of an existing and established organisation; or a composite formed from elements drawn from several existing organisations. The most appropriate organisation will certainly vary greatly from country to country. Thus the structural mechanism, functions and even the co-ordinating potential of potential candidate organisations, be they public, private or both, must be studied in depth, in relation to the prevailing social, economic, and political climate. A list of organisations suitable for implementing the HIS in other countries, being close counterparts to those UK organisations described here, has been included in Appendix B.

2.2. DATA TYPES AND ASSOCIATED METHODS OF DATA COLLECTION

Data on a housing scheme may be obtained through the measurement and appraisal of schemes appearing in current design publications, including periodicals, monographs and reports. However, the serious limitation of this method lies in the extent and scope of scheme coverage and associated detail, which is likely to be sparse, intermittent, and disorganised.

Thus, apart from the data obtainable from publications, there are *three* kinds of data categorised according to the methods used for their acquisition:

(1) Data which can be extracted from the set of formal documents and attendant drawings for building application through **desk appraisal and measurement**, whether they are acquired through official channels or from the original designer.

(2) Data which can only be obtained from **field appraisal and measurement**, i.e. by observations and/or interviews conducted on housing sites.

(3) Data which can be obtained through **correspondence with project participants**, particularly the original designer, by means of a standard questionnaire.

2.2.1. DOCUMENTARY DATA: DESK APPRAISAL AND MEASUREMENT

The information content required of formal documentation will normally be standard throughout each country, although the format of the application forms will vary somewhat from district to district or from region to region. It normally comprises a set of application forms, together with plans, elevations, sections, and detail drawings annotated with dimensions and text. For larger projects, supplementary specifications containing information on the type and quality of construction, materials, fixtures, etc. may be needed. Application forms normally carry brief but essential information about the client or client organisation, architect, site, building, estimated cost, and the detailed proofs of conformity of a particular project with building regulations and standards. In the UK, the information which must normally be specified in the planning and building application forms are as follows:

(1) Planning application:

Name, address and telephone number of applicant; nature of proposed development; location of project site; proposed use and existing use if applicable; estimated construction costs; description of materials including colour; cubic contents of the building; agricultural holding certificate; and notice to parties holding interest in neighbourhood land.

(2) Building application:

Name, address and telephone number of applicant; nature of proposed operations; location of project site; estimated construction cost; and proposed use.

Whilst in some countries considerable detail is required for both planning and building applications (see Appendix C for examples), the requirements of most UK authorities is generally less detailed. The format of application forms and the degree of detail contained therein will have implications for the economics of the implementation of the proposed service.

More detailed data about the physical description of a housing scheme can be obtained from drawings and specifications, but these naturally incur a great deal of extra effort, especially in the case of drawings. For the purpose of collation, authorities who examine the applications are likely to use their own checklists to make sure that all the details supplied with the application conforms to prescribed criteria, e.g. building regulations and official design guidance. Some dimensional data will be taken off from the drawings, and collated to the checklist. Obtaining that data, if it were available and could be properly utilised by the HIS, would lead to considerable savings in the cost of data acquisition. Much of the data acquired in this way will be relatively objective and static over time.

2.2.2. FIELD DATA: FIELD APPRAISAL AND MEASUREMENT AND CORRESPONDENCE WITH PROJECT PARTICIPANTS

However detailed formal documentation may prove to be, it will certainly not comprise the full data requirements of the proposed HIS. Thus there arises a need for complementary sources of data.

The 'missing' data is that which may only be obtained by field observation; collected either by making site visits or by personal contacts (or telephone or postal enquiries) with the parties concerned, i.e. residents, client, architect, quantity surveyor, and management officer.

It has been pointed out that direct observations are costly and time-consuming. Furthermore, results are likely to be so subjective and non-static over time that they must be processed with great care. Obtaining data from field observations will, in general, be more difficult and expensive than from pre-formatted documentation. However it will give a deeper insight into users' satisfaction with the resulting scheme.

Telephone or postal enquiries using a standard checklist or questionnaire may serve equally well for collecting feedback from project participants (e.g. the designer's feedback on a resultant scheme as opposed to his initial intentions and the constraints imposed by the client) or for obtaining detailed factual data beyond the normal scope of standard documents and drawings. Some measure of elemental costing feedback might also be acquired directly from the responsible designer or quantity surveyor. Face to face interviews for this purpose are impracticable.

A possible danger with using data obtained through communicating with the original designer may be his or her deliberate falsification of facts. Typically, appraisal of a resultant scheme by the original project designer may be rather less than objective. This would tend to show up as the blurring, disguising or attempted justification of original design misjudgements - quite simply, the designer will not wish to admit to his mistakes. Nevertheless, such information could offer invaluable information on how the present form of a housing scheme evolved from the initial brief, a crucial factor which might not otherwise be deduced from other methods.

Obtaining data from correspondence with project participants is dependent largely on their degree of co-operation. However, it need not be wholly prohibitive, especially in information-rich countries where sources of information are many and widespread.

2.3. PHASING OF THE IMPLEMENTATION

Full scale implementation of the HIS from the outset of its development is not considered advisable, in view of the common experience of unforeseen problems arising in the development of any large service. The considerable costs of the immediate full scale implementation of the HIS would present too great a risk in terms of human effort and necessary capital outlay.

It is therefore recommended that the implementation takes place in phases where this is possible. General strategies for phasing, which do not place unacceptable first limitations on the scope of data coverage considered necessary for the efficient functioning of the HIS, are:

(1) Starting with a limited geographical coverage.

(2) Starting with one or more particular types of housing in terms of its physical form, residential density, etc.

(3) Starting with schemes for architects or a few particular types of user group (here again, the issue regarding criteria of schemes to be involved would arise).

(4) Starting with more easily manipulated aspects of housing in terms of data collection and analysis, i.e. explicitly measurable aspects.

(5) Starting with more general information categories, before expanding to increasingly greater levels of detail within those categories. For example, a concise elemental costing as a more general level than detailed cost analysis.

(6) Any combination of the above.

Expansion of the system would be gradual, so that any unforeseen problems could be discovered and dealt with in the earlier stages, thus obviating the need for a possible major restructuring of the system later on.

The overall strategy recommended is to take maximum advantage of existing formally documented and coordinated data, in order to save on costly collation of otherwise fragmented data, and to ensure the widest possible coverage of housing schemes with the given resources. If possible, depending upon the involvement of the organisation concerned, a compromise may be made over changes to existing forms for recording building information (i.e. building application forms and forms unique to each potential organisation) to a format serving equally as the standardised data sheet for the proposed service. This strategic approach implies the incorporation of the HIS within some existing agency or organisation, which should already possess considerable data resources, or be influential enough to ensure adequate collection of data from individual data sources. However, it should be recognised that there must be some obvious return to such an organisation for its efforts. This, of course, applies equally to any organisation selected as a potential source of data for the HIS.

It should be made clear that the HIS has wide ranging application and is not intended for the sole benefit of a single client or professional group. However, this may not be particularly obvious where the service is instituted within the organisation of just one such group. As described in Chapter 5, the ability to extend the HIS's usefulness to all groups of practitioners concerned in housing affairs is very desirable, as far as it is practicable. Although this may somewhat modify the characteristics of the HIS as originally envisaged, it may be considered as inevitable, in view of the better cost-benefit obtained.

2.4. THE POTENTIAL FOR INTERNATIONAL IMPLEMENTATION OF THE H.I.S.

In parallel with a regional or national scale implementation, the idea of international implementation may be considered. For the international implementation however, coverage of the various aspects of housing schemes, and their associated levels of detail, would have to be limited, since essential data, techniques of analysis and related classification systems for housing would differ from country to country. There will be different cultural, economic and social patterns, bringing about different price structures for building goods, services and land. There would also be differing preferences for building forms, structures, indoor environmental controls and surrounding environments. Thus the data coverage for an international service would tend toward the general. Even if it were very detailed, its value to practitioners in other countries would be reduced owing to the above-mentioned significant differences. Nevertheless, there is undoubtedly a value to architects and developers in a system offering information on building practice, construction techniques, and architectural sources drawn from all over the world - for example, the Swedish patio housing type and Japanese techniques of garden design have been successfully applied in many countries.

Sources of housing data for an international implementation could be acquired through collaborating with foreign counterparts to those organisations previously discussed, or by referring to international periodicals, monographs and housing studies. The first of these approaches would certainly call for considerable international co-operation but would not necessarily need to involve those organisations having particularly close access to public building documents, since fewer samples of schemes and their lesser detail would be needed than in the case of a wholly domestic service. Typical organisations would be professional bodies of architects co-ordinated through international organisations like the International Union of Architects (UIA), the International Council for Building Research, Studies and Documentation (CIB) or the International Federation for Housing and Planning (IFHP). Other suitable international co-ordinating organisations may include the Housing, Building and Planning Committee of Economic Commission for Europe (ECE), International Union of Building Centres (UCIB), International Congresses for Modern Architecture (CIAM), International Federation of Surveyors (FIG), European Union for Private Housing Constructors (UECL), etc. The service at this scale would consist of an international database of housing information maintained in high density storage, accessible worldwide for both input and access.

3. COPYRIGHT: LEGAL CONCERNS OF DATA COVERAGE

As a final point, the various problems of 'intellectual ownership' of design information must be considered in relation to the intended collation and distribution of housing information. In particular, potential disputes regarding designer's copyright must be clearly answered.

There are two main international agreements over copyright protection which form the basis of copyright law in most countries: the Berne Convention of 1886 and the Universal Copyright Convention (UCC) of 1952 (sponsored by UNESCO). Outside any special arrangement, copyright for any architectural design lies with the architect, not with the occupant or owner of the building. This implies that the architect can make further use of his work, if it is appropriate, when making plans for other buildings, and that the owner of the building cannot erect duplicates of his building without the consent of the architect [13].

This copyright extends only to the design drawings (plans, elevations, etc.) for a building, whereas the model and the finished (or unfinished) building may be freely photographed and published, or included on films and TV without permission.

Filed applications in public offices are open to public inspection and become public documents. It is internationally common practice that they are made public on the request of any interested person. Public exhibitions and hearings are frequently held where the social and planning consequences of some proposed project may be considered significant. The particular problem posed by the intended use of information to be distributed by the HIS lies in whether or not the copyright of an architect is infringed by the making or supplying to any person of any reproduction of the work filed in a public office or professional organisation. Information written on the specified forms provided by local authorities does belong, strictly speaking, to that authority, but graphical data, in the form of drawings, may *not* be deemed to belong to them. Thus the dissemination of graphical information raises an issue of copyright. In some countries, including the UK [14], reproduction of filed drawings is prohibited (not explicitly codified in law, but interpreted as such); whereas in others, such as the USA (where all information recorded or filed for permits is public information under the freedom of information act of 1968), it may be allowed. In countries where full copyright laws are in force, processing of filed applications is only possible with the explicit permission of the original architect.

The reproduction of material from secondary sources of data, e.g. periodicals, design source books, etc., may be yet more complicated. Where reproduction of a photograph of a building is required, permission must be obtained only from the copyright holder of that photograph. But where the requirement is for the reproduction of a photograph of a design drawing, it is likely that permissions will be needed from both the copyright owners of the photograph and of the design drawing itself.

In reality, architects are frequently put in the situation where they cannot claim copyright unless a design has, either wholly or to a very great extent, been copied as the source for another building. Straightforward copying of another person's design is certainly in violation of copyright law, but in many cases things are not quite so obvious. (In the rare cases where one designer virtually duplicates the work of another by coincidence - that is, without copying - he has equal rights to design copyright [15].) Where this is the case, the *degree* to which a design has been copied is often very difficult to assess, as copyright does not extend to ownership of a concept or *idea*. There are also a number of intricate cases involving disputes between architects and their clients over copyright ownership.[2]

The main concern of architects should not be with the degree to which their design documents and drawings are generally distributed, but the extent to which those actual designs are effectively copied. In practice, many drawings from prominent designs are regularly and publicly exhibited, circulated through the professional journals or included in books, TV programmes and films. Few architects are going to quibble over copyright issues where there is the prospect of free advertising.

Whilst there is no longer any technical or economic reason why designs cannot be copied straightforwardly from design journals and the like, it is not seen as anything but a very minor problem from the point of view of copyright. It would be rather absurd to worry that easier access to the details of existing schemes provided by an information service would instigate more breaches of copyright. There would seem, therefore, to be little concern over the publication and distribution of design documentation. The collection, processing and dissemination of graphic information by the HIS should therefore not be adversely affected by the current state of copyright law. Rather, it should be regarded as the public sharing of useful information. Were this not the case, the coverage of schemes and attendant detail of data by the HIS would naturally be limited, with permission from each individual architect needing to be obtained through co-operative agreement or royalty payments. Customarily, it is common practice for the architect to grant unconditional permission in such cases, but there remains still the cumbersome task of obtaining permission

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2 Readers are referred to an article in the Architects' Journal [16] which contains a pithy description of three such controversial cases.

from each individual architect concerned.

The discussion so far has focused on those drawings filed with public or professional organisations, the contents of which are generally limited to plans showing general arrangements of housing schemes, i.e. a set of site plans, foundations plans, floor plans, sections, elevations, roof plans and structural drawings as necessary. If further detailed drawings were to be handled by the HIS, the potential copyright problem will not be as simple as that for more general drawings (i.e. those accompanying building applications). Such drawings are likely to contain many technical design features which will have been developed at considerable expense. It is most unlikely that these could be openly released by the original architects without considerable recompense being made to them.

This chapter has set out in global view the preliminary concerns of data coverage, potential implementing organisation, design copyright, which are prerequisite to any implementation of a housing information service. Based on this investigation, the next chapter will explore the data elements and their associated structure for the proposed service as it might be implemented universally and more specifically in Korea.

CHAPTER SEVEN

THE DATA STRUCTURE FOR THE HOUSING INFORMATION SERVICE

Decisions on the scope of data coverage and the related data structure[1] for any information service call for careful consideration as, once selected, they will have important implications for the use and future development of the service.

These decisions require intricate compromises between the ideal and the practical and will necessarily be of a somewhat subjective nature. However, every effort has been made to select data on an objective basis by, as far as possible, consulting a number of practitioners including the participants involved in the pilot studies (to be described in the forthcoming Chapters 11 and 12). As a result, five levels of data, describing six major aspects of housing, have been evolved for the Housing Information Service which might be implemented in Korea.

This chapter consists of two sections. The first describes the particular criteria for the data selection, and the second, the associated data structure developed for the HIS.

1. CRITERIA FOR DATA SELECTION FOR THE H.I.S.

1.1. LEVELS OF SCHEME ANALYSIS

Data selection for the HIS bears a direct relation to the appraisal and measurement techniques which are important to every design activity. Appraisal and measurement is the means by which feedback information about the performance of a past design can be used to ensure a method for continual design improvement. In addition it provides an objective

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1 'Data structure' is here meant to be the organisation of data, arranged with respect to housing appraisal. It should not be confused with the technical data structure internal to computer systems.

framework by which the design activity can be, to an extent, made explicit, offering a means whereby the designers' explicit aims can be made known and their resulting performance more objectively assessed [1]. This has obvious advantages in assisting teamwork and continuity among personnel on lengthy projects.

To measure and appraise the quality of housing design, it is necessary to be able to describe the characteristics that contribute to it. There are many aspects which comprise the complexity of each housing scheme. These range from the readily quantitative and objective, e.g. spatial, economic, constructional, to the unavoidably qualitative and subjective, e.g. social, aesthetic, physical/physiological. Each of these, in turn, consists of a very large number of subcomponents.

As outlined in Chapter 6, the description of a housing scheme may be infinitely fine-grain. Fine-grain description however, does not always increase descriptive value; whilst too little data tends to give an incomplete description, too much will often result in data redundancy, eventually leading to needlessly higher costs of the information product. From a practical point of view, it is important to optimise the description of a housing scheme within reasonable boundaries, with particular reference to the information requirements of potential information users.

Furthermore, one of the keys to any successful large scale information service is to reduce the number of data items to the essential minimum, at least for an initial period. Thus it is necessary to identify and classify the most important and fundamental components of housing schemes. In addition, the wider extent and scope of data coverage need to be taken into careful consideration: although the HIS is primarily for the use of architects, it is advisable, for greater cost-effectiveness, that the data coverage be sufficiently broad, based on agreed conventions, to cater for the information needs of other groups of practitioners involved in housing development.

Thus the first criterion has been to select that data which is indispensable for the appraisal and measurement of housing schemes from the viewpoint of all potential user groups. These data items in effect coincide with those which are critical to the identification of housing schemes of interest. The selection has been further affected by certain operational principles, which are:

(1) That data should be readily obtainable without incurring excessive cost and effort.

(2) That data should remain reasonably static with respect to time.

(3) That data not covered by the system should be referenced so that sources of further information are identified.

1.2. INTEGRATION OF DRAWINGS INTO HOUSING ANALYSIS

The above criteria have been evolved on the assumption that the service will provide graphical as well as written information.

The level of analysis of a scheme should accord with user demands. We have already observed the attitudes of architects towards design information. Architects tend to scan information rather than study it in any depth; they claim that they do not have much time to spare for information research and would like information to be as concise as possible. In dealing with this, the HIS should employ a variety of graphical forms which may be used to convey information rapidly and simply.

In architectural design and related fields, written information is by no means the sole type of information. Designers tend to think in terms of graphical images. The role of graphical information, especially in the form of drawings, cannot be overemphasised in a design information service such as the HIS. Drawing has always been the traditional medium of information transfer and communication among building related practitioners and, like every such medium, it has its own vocabulary and syntax, easily and precisely understood by them.

For many kinds of information, drawings are the simplest and most condensed medium for information transfer. The provision of drawings within the HIS would save a great deal of time and effort not only for information users in understanding the schemes identified, but also for an eventual implementing body of the HIS in its preparation of detailed measurement and appraisal in order to accurately convey the character of each scheme. Drawings are also a means of conveying the performance of each scheme without necessary recourse to the subjective opinions of others, so that appraisal can be made by the users themselves. Without the incorporation of drawings, the potential uses and benefits of the service would be considerably reduced.

2. DATA STRUCTURE FOR THE H.I.S.

2.1. PROPOSED LEVELS OF SCHEME ANALYSIS IN RELATION TO METHODS OF DATA COLLECTION

Examples of housing schemes for the HIS may be found through bibliographical searches or by asking interested parties. Subsequently, the data for the selected schemes will be obtained by standardised methods in order to ensure consistency in information detail across all the housing schemes to be processed. Based on the predetermined criteria of data coverage, it has been decided to relate levels of housing analysis (to be carried out by the service) to data types which can practically be obtained from four methods of data collection. The proposed levels of housing analysis and corresponding data types are as follows (Table 1):

TABLE 1. Proposed Levels of Housing Analysis and Corresponding Data Types

Level of Analysis	Type of Data
1 *	Concise factual description
2 *	Detailed factual description
3 **	Designer's intentions & constraints
4 ***	User satisfaction
5 ****	Published coverage (complementary written sources to the above 4 levels)

Key * **Levels 1 and 2** analyses will be carried out through desk appraisal and measurement of a set of building applications for building warrant.

** **Level 3** analysis will be carried out by correspondence with the original designer.

*** **Level 4** analysis will be carried out by field appraisal and measurement. However, much of the groundwork will be relieved by communicating directly with on- or off-site personnel responsible for housing management or maintenance.

**** **Level 5** analysis will be carried out through desk appraisal and measurement of current design periodicals.

Each level of analysis in Table 1 will be carried out using its own standard form for appraisal and measurement. Each analysis however, will be directed towards six major aspects of housing, as shown in Table 2.

TABLE 2. Scope of Proposed Housing Analysis

Programme	Site	Spatial	Physical	Constructional	Economic
<------------------------------------ Level 1 ------------------------------------>					
<------------------------------------ Level 2 ------------------------------------>					
<------------------------------------ Level 3 ------------------------------------>					
<------------------------------------ Level 4 ------------------------------------>					
<------------------------------------ Level 5 ------------------------------------>					

The fundamental difference between Level 1 and Level 2 analyses is the degree of complexity to which the analysis is carried out, reflecting the degree of designers' consensus regarding the most critical data for the appraisal of a housing scheme. Thus the first level consists of that data most widely used by architects in their appraisal of housing schemes, and has the potential for international application.

Level 5 analysis is devised to support each of the other four levels by providing references to complementary sources of written information.

2.2. THE CLASSIFICATION OF DATA FOR THE H.I.S.

The data structure of the HIS should aim to provide standardised guidelines not only on the measurement and appraisal of the quality of housing, but also on organising the information generated therefrom. Furthermore, although all methods of classification become obsolete at some point, the data structure for the HIS should be sufficiently flexible to meet newly arising needs in the foreseeable future.

Being essentially subjective in nature, a decision on the method of data classification depends primarily on its intended use and on its ease of adaptation from existing classification systems (with which prospective users should already be familiar). Having established the initial concepts and criteria of data coverage, extensive research has been carried out on relevant references relating to current housing practice. This search has involved the various building and housing related planning/design criteria, checklists and classification systems used by various private and public organisations, and in regulatory controls and contractual arrangements in Korea as well as many other countries.

Reviews have also been carried out of the critical characteristics used in various countries for the appraisal of housing quality, such as those of the American Public Health Association [2] and the National Swedish Institute for Building Research [3]. However, it was soon found that such groupings of characteristics were evolved mainly for describing essentially substandard dwellings and housing areas in order to consider possible renewal action or slum clearance. Clearly, this bears no direct relation to the characteristics necessary for the proposed HIS.

Existing classification systems were scrutinised along two lines of investigation: one exclusively for housing classification, and the other for general building classification.

Relatively few housing oriented classification systems exist either in Korea or in other countries, and most of those in use are mainly concerned with housing management or maintenance. The principal exception is that developed for the Housing Intelligence Bank Scheme proposed by Crofts [4] and Gibbons [5]. Although somewhat idealised, it is the first detailed classification system devised specifically for the measurement and appraisal of qualitative aspects of multi-family housing, with particular reference to housing layouts and performance of the designer. It has served as a primary reference in the development of a classification system for the HIS.

Current general classification systems fall into two broad categories: one for sectional aspects and the other for comprehensive aspects of building or building activities. Particular reference to the following, internationally used, general systems has been made:

(1) For **sectional** aspects of buildings :

- Standard Form of Cost Analysis (SFCA) of the Royal Institution of Chartered Surveyors (RICS)
- SMM6 of RICS and the National Federation of Building Trades Employers
- Mastercost of the American Institute of Architects (AIA)
- CIB Master List of Properties for Building Materials

(2) For **comprehensive** aspects of buildings :

- Swedish SfB, UK CI/SfB, French SI/SfB and German BRD/SfB
- Uniform Construction Index (UCI) of AIA
- Danish Coordinated Building Communications (CBC)

- Canadian Building Construction Index (BCI)

- Building Industry Code (BIC) of the UK Department of Education and Science

- Common Arrangement of Work Sections (CA) of the UK Co-ordinating Committee for Project Information

Particular characteristics of the most internationally used classification systems among those above are as follows (Table 3):

TABLE 3. Characteristics of Some International Classification Systems

System	Coverage	Use	Notation	Relation
SfB	B.C.	International	L&N	H&F
CI/SfB	B.C.	International*	L&N	H&F
UCI	B.C.	USA & CANADA	L&N	H
CIB Master	B.M.	International	N	H

Key B.C. building & construction , B.M. building materials
L letters , N numbers
H hierarchical , F faceted

N.B. * Most extensively used in UK and Scandinavia.

As general classification systems have been developed for all types of buildings, it was found that their relevance to the unique classificatory needs of a particular building type declined. In fact, they have all been developed primarily for the arrangement of architectural libraries, whereas the classification system concerned here is intended to be used for the standardised measurement and appraisal of a specific building type (i.e. housing). Nevertheless, much of what they have to offer has been taken into consideration, especially in the selection of Level 1 data.

Since there is no comprehensive standardised classification system used in the Korean construction industry, the references have been restricted primarily to the popular sectional classification systems and their constituent data elements, e.g. national standards specifications, contractual clauses, and various other proprietary systems used in large practices. Along with those referred to above, the Korean building application form has been taken into particular consideration because of its importance as a primary data source. For some areas, where no existing classification is yet available, reference has been made to foreign classification systems, taking account of their application in the context of Korea.

Apart from the classification schemes already described, there is another form of building classification developed by a number of architectural theorists to describe the complexity of buildings, notably those of Markus [6] and Broadbent [7]. While they demonstrate interesting taxonomies, their structures are often very abstract, subjective and oversimplified. Their application to a practical classificatory need is rather weak.

Together with literature searches, interviews with housing related practitioners in Korea and the UK have been made in order to receive their views regarding the most essential information in practice. During these interviews, it became clear that a general consensus exists regarding essential information, but with differing emphases according to occupation and type of organisation, e.g. theorists and researchers versus practitioners; public versus private sector.

At the final stages of investigation, a number of experts associated with the planning, design and management of housing were consulted again to give a final touch to the data categories chosen by the author. As a result, a fixed number of 1,220 data items, distributed over the first three levels of analysis, and a smaller, variable number of data items at both the fourth and the fifth levels, have been selected for the six predetermined major aspects (see first two columns of Table 4). It should be noted that the data elements deducible from a combination of other (primitive) data elements are excluded from the data initially selected since they can always be recreated from primitive data: for example, 'household density', which can be calculated from the primitive data values of 'total number of households' and 'site area', by simply dividing one into the other.

Levels 1 and 2 in combination are concerned with the factual and objective description of a housing scheme. Level 1 is in effect a subset of Level 2, which may be used independently for a concise description of a housing scheme or for international application of the HIS. Within the first two levels of housing analysis, each aspect consists of ever smaller subject domains until individual data items are reached, which altogether amount to 1,211 data items including 53 data items for Level 1. Subordinate groupings have been classified, wherever possible, according to familiar classification schemes, so that users can identify their domains of enquiry quickly and without recourse to any specialist knowledge of the particular system employed. The structure is shown in Table 4 below.

TABLE 4. Data structure of the Housing Information System

Major Aspects	Sub-aspects	Groups
Programme :		1. Scheme identification 2. Nature of development 3. Demography 4. Project participants 5. Project schedule 6. Statutory controls
Site :		1. Site form and features 2. Site ecology 3. Planting 4. Site location
Spatial	: 1) External	1. Number of separate blocks to different building type and storeys 2. Building and traffic layouts 3. Roads, paths and parking provisions 4. Area distribution 5. Travel distance
	: 2) Interior	1. Units 2. Blocks
Physical :		1. Aural 2. Olfactory 3. Visual and onlooking
Technical	: 1) Constructional type	1. Building structure 2. Building components
	: 2) Services and welfare facilities	1. Public services and utilities 2. Communication facilities 3. Lifts and hoists 4. Heating 5. Fire protection provisions 6. Security provisions 7. Refuse disposal 8. Site fixtures and furniture
	: 3) Building materials and finishes	1. Interior 2. External 3. Site fixtures and furniture
Economic :		1. General 2. Sources of finance 3. Elemental costing 4. Management and maintenance costs

The details of each group of characteristics for the first two levels is as follows (the complete data for both levels is contained in Appendix D):

(1) **Programme** : This set of characteristics lays down the guidelines for the evolution of the present form and layout of the scheme. This includes nature of development, demography, project participants, timetabling phases of the scheme, and statutory controls.

(1.1) Scheme identification: Identification of a scheme with its name, location and administrative local authority.

(1.2) Nature of development: Various characteristics particular to a scheme, e.g. types of development body and tenancy arrangements.

(1.3) Demography: Particulars of age group of residents.

(1.4) Project participants: Particulars of all the key participants in a project, i.e. client, architect, contractor and housing management body (so that any enquiries concerning further detail of the scheme may be made to them).

(1.5) Progress schedule: Chronological history of a project from original building application to the latest alteration (or demolition).

(1.6) Statutory controls: Key statutory regulations governing the form and layout of the scheme.

(2) **Site** : Original and man-made conditions of the site and its relationship to immediate regions and prevailing climate are described.

(2.1) Site form and features: Physical form and size of the site; and particularly, natural features within and adjacent to site.

(2.2) Site ecology: Ecological and environmental aspects of a site, i.e. topography, climate, soil and geology.

(2.3) Planting: Types and quantity of vegetation planted on site, i.e. trees, shrubs, ground covers and grass.

(2.4) Site location: Location of site in terms of travel distance to public and welfare facilities such as, city centre, post office, hospital, bank, bus stops.

(3) **Spatial: External** : Describes the form of building blocks and their arrangements in relation to traffic layout, and subsequent external area distribution resulting from the layout.

(3.1) Number of separate blocks to different building types and storeys: Number of separate blocks in various form of housing and other forms of non-residential building, together with number of storeys particular to them.

(3.2) Building and traffic layouts: Type of traffic segregation, garaging and parking together with form of building arrangements which describes the overall pattern of external layout.

(3.3) Roads, paths and parking provision: Length and width of internal roads and paths, and number of parking spaces allocated to residential and non-residential purposes.

(3.4) Area distribution: Area allocation of site to various functions and facilities.

(3.5) Travel distance: Travel distance to various on-site facilities from the nearest and the farthest dwellings.

(4) **Spatial: Interior space** : Describes layouts and area distribution within units and building blocks.

(4.1) Units: Number of units according to different housing form and bedspaces; together with a detailed space-function description for instances of the most widely used unit type, smallest unit type, and largest unit type.

(4.2) Blocks: Floor areas of residential and non-residential buildings; and geometrical and spatial descriptions of typical housing and shopping blocks.

(5) **Physical** : Physical/physiological experience of the residents is one of the essential indications by which the performance of the building construction and layout can be assessed. This group of characteristics describes measurements bearing upon the physical/physiological performance of the buildings and layout.

(5.1) Aural: Nature and location of various noise sources within and outside estate, and attendant noise rating.

(5.2) Olfactory: Nature and location of sources of obnoxious smells within and outside estate.

(5.3) Visual and overlooking: The provision of visual privacy and daylighting with particular emphasis on proximity of dwellings and between dwellings and onlookers.

(6) **Technical: Constructional type** : Types and forms of building structure and attendant components are described.

(6.1) Building structure: Structural frame, foundation, floor, roof, etc.

(6.2) Building components: Various building components such as windows, doors, stairs and balconies.

(7) **Technical: Services and welfare facilities** : This describes the provision of services and facilities which are related to the comfort, security and welfare of the residents.

(7.1) Public services and utilities: Capacities of public services and utilities such as electricity, water supply and disposal, and gas.

(7.2) Communication facilities: Provision of telecommunication facilities, e.g. TV aerial, telephones, switching and broadcasting systems.

(7.3) Lifts and hoists: Provision of lifts, escalators and hoists.

(7.4) Heating: Description of heating methods and types including heat sources, boiler size, HVAC systems, solar system and heat emitters.

(7.5) Fire protection provisions: Provision of systems and equipment relating to fire protection such as detectors, extinguishers, hose reels, fire-resistant doors and so on.

(7.6) Security provisions: Provision of security devices and equipment such as door viewers, videos, shutters and intruder detectors.

(7.7) Refuse disposal: Methods and convenience of refuse disposal.

(7.8) Site fixtures and furniture: Quantities of various types of site fixtures and furniture, including play and recreation equipment.

(8) **Technical: Building materials and finishes** : The quality of construction and the final appearance of the resulting buildings are by and large dependent on the building materials used. This set of characteristics describes in detail both internal and external building materials.

(8.1) Interior: Forms and finishes of surface materials used on interior space.

(8.2) External: Forms and finishes of materials used on external surfaces of buildings, boundary walls and pavements.

(8.3) Site fixtures and furniture: Forms and finishes of various site fixtures and furniture, including play and recreation equipment.

(9) **Economic** : The economic history of building remains the foremost concern of building practitioners as it indicates how value for money has been effectively achieved. This describes the particulars of construction, operational, and management costs.

(9.1) General: Particulars of tender and contract applied to the scheme.

(9.2) Sources of finance: Proportion of construction costs from various financial sources, which are spent on residential and non-residential development respectively.

(9.3) Elemental costing: Construction costs for residential and non-residential development, which are distributed over various construction elements including profit and tax.

(9.4) Management and maintenance costs: Annual costs of housing management and maintenance for residential and non-residential buildings.

Level 3 consists of 9 data items, each describing the designer's initial objectives and constraints in each of nine particular aspects of housing.

Level 4 is concerned with user satisfaction and requirements. As described earlier, user satisfaction with housing schemes is the result of an interaction of many factors, it thus being difficult to attribute it to any one single definite cause. In order to ensure a more precise identification of the nature of user satisfaction, the number of data items for Level 4 is left open-ended. Each data item is defined in terms of some combination of 7 categories, each of which represents a particular aspect of living quality, e.g.

physical/physiological, services and ergonomics. Therefore, in Level 4 analysis, each data item is accompanied by a set of up to 7 factors representing the nature of user satisfaction related to that item.

Level 5 is concerned with the onward referral to current design periodicals. The number of data items for Level 5 is also left open-ended, as the level of published coverage will vary greatly from scheme to scheme.

The complete lists of Levels 3, 4 and 5 are contained in Appendix D.

CHAPTER EIGHT

USER-SYSTEM COMMUNICATIONS

Achieving satisfactory communications between users and the system is the most critical function of an information service. The effectiveness of system-user communications[1] will therefore ultimately determine the overall success of the service. This chapter comprises three sections. The first focuses on the information retrieval process, and the role of an 'information intermediary' linking the information user with the system. The second delves into the various ways and means of disseminating information and publicising the existence of the service to potential users. The third section reviews technological options relating to the user-system communication of the HIS.

1. INFORMATION SEARCH

1.1. DATA CHARACTERISTICS

In the appraisal and measurement of housing schemes, some factors will be capable of numerical expression, e.g. area measured and cost incurred; some will merely be answerable as 'yes' or 'no', e.g. "is an intruder detector provided?" ; and some will be descriptive, e.g. appraisals by the designer and firsthand users of buildings. In some cases, these descriptive elements may be indicated through selection from a menu using relevant indices, thereby also facilitating any subsequent search process. In the HIS, Levels 1 and 2 data are mostly established as numerical, simple yes/no, or indexed representations, whereas Levels 3 and 4 are mostly established as descriptive passages (free-text), but in a compact form to minimise redundancy of description by using standardised abbreviations

1 User-system communications are here meant to be the processes or procedures the information user has to go through before he or she can obtain the desired information from an information system.

or acronyms. Level 5 data is established using all four types of representations.

Enquiries at Levels 1 and 2 initiate the matching of a set of the enquirer's stated requirements against the stored sets of scheme characteristics, whereas the Levels 3 and 4 data may be used to check, respectively, the designer's initial objectives against actual building performance, and the user response with a resultant scheme. Level 5 data will be used to locate further supplementary sources of written information to that information found at the four main levels.

It should again be noted that stored data elements are restricted to those which may be considered 'primitive' or 'primary': elements which may be derived from two or more primitives are not recorded. The ease with which these non-primitive data elements may be derived is dependent upon the data file structure employed by the computer system, which is in turn dependent upon the constraints imposed by both hardware and software.

Technologically, it becomes ever more possible to accurately describe or model objects. In practice however, there is a correspondingly heavy burden placed on data preparation and entry and more critically, significant redundancies in the resulting storage of information. In this respect, object descriptions are simplified to the necessary minimum. For example, in the description of materials used on walls, only the two most dominant materials are recorded. Nevertheless, provision is made to inform the user of the total range of variety, so that he or she may refer to the appropriate drawings or specifications stored in graphical form for a more complete description. Such optimisation is based on the assumption that the system will be capable of allowing interactive displays of drawings or specifications of schemes of interest.

The overall data storage requirements encompassing all four main levels of data and the ancillary onward referral data (except for graphical data) may be estimated at around 20,000 characters for each housing scheme. Assuming that the system is initially to include information on around 3,000 schemes, a file size of 60 million characters (60 megabytes) seems to be a reasonable estimate.

1.2. INFORMATION RETRIEVAL

Numerical values attached to the various recorded scheme characteristics are used in achieving a match with an enquiry. For descriptive passages, keyword searches may be incorporated.

A search begins with the enquirer specifying a set of requirements. As the number of requirements increases, there will naturally be less chance of an accurate match. Thus, in most cases, it will prove wiser to begin the matching process with just one or two most significant requirements before proceeding to the others as the enquirer evaluates the alternative schemes put forward.

Where a precise match does not occur, some form of computation will be required in order to discover schemes meeting the enquirer's requirements as closely as possible. Particularly in the case of numerical conditions, enquirers would be required to specify the allowable deviation from the central requirement, in order to locate those scheme(s) most closely matching their requirements.

Suppose there is to be a simple search for schemes consisting of flats on 5 acres of land and with a density of 100 p.p.a. While the condition of 'flats' must be matched precisely, the two numerical conditions may, in all probability, require only a reasonably close fit. In such cases, the enquirer will search for schemes that match the given 100 p.p.a to the nearest of, for example, +- 5%, that is, **95 p.p.a. < Schemes in Question < 105 p.p.a.** If this does not produce suitable schemes, the process may be repeated with a larger deviation, for example, +- 6% and onwards, until suitable scheme(s) are found. The system will then be operated to identify those schemes built on site areas of approximately 5 acres from the schemes located in the previous process. If there proves to be no scheme built on exactly 5 acres, an allowable deviation shall again be specified until a usable set of schemes is located. The sequence of the retrieval operations may be in any order.

1.3. PROGRAM LIBRARIES

Searches in particularly common demand will have to be subroutined[2] in order to

2 A subroutine or sub-program is a well-defined part of a program which carries out a logical part of the functions of the complete program and which can be called into action whenever the particular part is required.

save the repeated effort of programming them every time they are requested. These will mostly involve those searches carried out to identify schemes with one or more Level 1 data characteristics (e.g. population density, site area and construction costs). By doing so, these searches may then be executed simply by typing in a value or range of values of scheme characteristics of interest. They will in effect constitute a program library. An example search subroutine on the SIR/DBMS is as follows (see Table 1): a search for schemes meeting the requirements of "housing form *maisonette*, building storey *12*, building plan shape *Y* and internal access type *corridor split level*".

TABLE 1. Example of A Search Subroutine

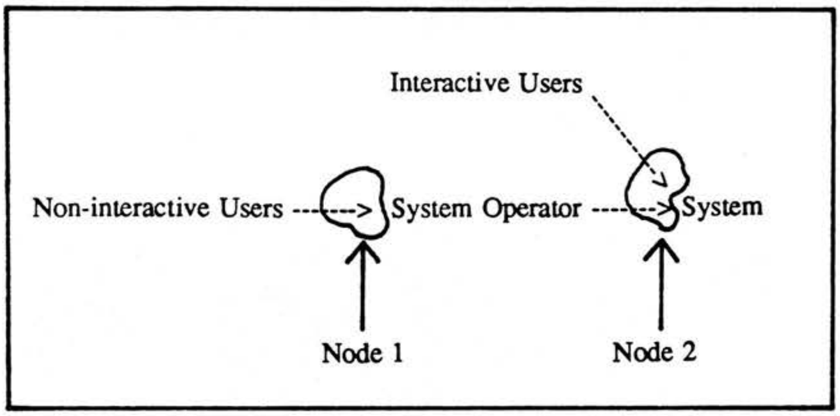
```
 10 C DEMO.SAMPLE
 20 retrieval
 30 process cases
 40 process rec 1
 50 move vars NAMESCH
 60 process rec 2
 70 if (BLDG ne 5) exit rec
 80 if (NOSTO ne 12) exit rec
 90 compute BDG=vallab(BLDG)
100 move vars NOSTO
110 process rec 4
120 if (vallab(PRED) ne 'P' and SHPL ne 10) exit rec
130 if (vallab(PRED) ne 'P' and TYAC ne 10) exit rec
140 compute SHP=vallab(SHPL)
150 compute TYA=vallab(TYAC)
160 perform procs
170 jump out
180 end process rec
190 out:
200 end process rec
210 end process rec
220 end process cases
230 report filename=SAMPLE/
240  print=NAMESCH('SCHEME') BDG('FORM') NOSTO('STOREYS')
250   SHP('PLAN SHAPE') TYA('ACCESS')/
260 end retrieval
```

In addition to the standardised search subroutines, publicly available data may form a separate library of data files. It may include detailed records on architects or contractors, prices of building materials and labour, or on local climate. These kinds of data are often readily available on magnetic tape or disc from the organisation concerned.

1.4. POTENTIAL CAUSES OF FAILURE IN SYSTEM-USER COMMUNICATIONS AND THE ROLE OF INFORMATION INTERMEDIARY

There are two categories of user distinguished by their mode of access to the HIS: interactive and non-interactive users. Interactive users are those who operate the system at first hand, using a terminal, whereas non-interactive users are those who gain access to the system only through a system operator. This may be shown diagrammatically as Fig. 1.

FIG. 1. The System-User Communication



To make the full use of an information system, good communications are essential between information users, operators and the system. But this is often hampered by many factors. Potential causes of failure in the system-user communication at each node in the above figure can be summarised as follows [1]:

(1) **Node 1 Failures** :

(1.1) Poor problem statement by non-interactive users - users will frequently give unclear or imprecise statements of the information needed; their particular needs are often difficult to express, and there is an imperfect understanding of the problem.

(1.2) Misinterpretation by the system operator - this arises particularly where the operator is poorly acquainted with the specific information needs of the enquirer.

(2) **Node 2 Failures** :

(2.1) Precision failure (how accurate it is): incorrect co-ordination of index terms; free-text terms in wrong context; search formulation not specific enough; and indexing too exhaustive.

(2.2) Recall failure (how much it misses out): failure to cover all possible approaches; profile narrower than interests; search strategy too specific; and incorrect indexing.

Many of the Node 1 failures (which are caused by improper communication between users and operators) can be allayed by the help of a trained information intermediary. The information intermediary is a middleman between users (especially non-interactive users) and the system (or the system operator). His role is firstly to translate the user's concerns into a set of specific questions which will be amenable to computer analysis, and subsequently to translate the output into a form the user can readily understand.

Information intermediaries may operate the computer system directly, or indirectly through a system operator - whether a staff assistant or a trained programmer. In either case, they should necessarily be keenly aware of both the particular information needs of the area concerned and the full capabilities of the system, in order to ensure effective user-system communications.

Generally, the frequency and complexity of enquiries will determine whether the information intermediary and the system operator are separate persons. In operating the HIS, an enquiry would, in many cases, need several consecutive queries to be carried out until the required final information output is obtained. Each step in this process inevitably increases the risk of communication breakdown between the user and system. To minimise this risk, it is considered to be far more efficient to have just one person playing both roles.

However, it is uncommon to find a person from the computing field with a parallel appreciation of the practical information needs of design practitioners, and vice versa. The practical option is therefore to recruit a person from one field and then to offer training in the unacquainted field. In view of the diversity of user groups and the complex nature behind their enquiries, the intermediary should be drawn from the architectural profession.

Judging from the author's experience of learning the SIR/DBMS (one of the moderately complicated database management systems in the current market, yet extremely powerful and flexible), a month's training (8 hours a day and 5 days a week) would be a reasonable estimate for the average lay person (from architecture) to get him or herself acquainted with the operating system[3] and database package to the level of being able to write serious application programs.

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3 An operating system is the basic software which supervises and controls the running of other (user-oriented) programs: the operating system allows the system (hardware) to operate the user programs designed to satisfy applications (i.e. application programs).

2. DISSEMINATION OF INFORMATION OUTPUT

2.1. USER ACCESS TO THE H.I.S.

There is little value in having an information service if potential users cannot get access to it when they wish to. Furthermore, there is evidence that much of the effort put into information search is hampered or simply abandoned because of access problems (or perhaps, unwarranted misconceptions about access to computers). In view of this, the ease and convenience of access to the service should be ensured using every possible means. Similarly, it may generally be assumed that the user has limited time to look for information of interest and will want rapid answers to immediate problems. Methods for disseminating information prove to be critical in coping with these potential problems.

The HIS may be accessed by users in two different ways: as a centralised data bank to which remote users may gain access through the telecommunications network, by postal service or personal visit; and by the distribution of compact forms of the database for use on local machines, e.g. magnetic tapes, magnetic disks, microfilm or microfiche. These methods of access are not necessarily mutually exclusive. In fact, the HIS may use both.

Obviously, the easiest way of gaining access to the system would be for each user to have a copy of the database in a compact form, updated on a regular basis. Against this however, every user must have a computer and operating software compatible with the HIS. Most current low-cost stand-alone microcomputers[4] have neither the processing power or memory capacity to achieve this (although this may not be true in the near future considering the pace of current information technology). Moreover, if any serious operational difficulties occur, the advice of an information intermediary will not be immediately at hand. Unless thorough 'help' instructions are included within each copy of the database, or some means of obtaining swift consultations with an intermediary provided, system-user communication problems could present a critical drawback of this approach.

Of the two ways of gaining access to the HIS, the centralised data bank is therefore considered the more practical way of disseminating information at present, especially in Korea. According to the chosen operating technology, the basic alternative ways of

4 A stand-alone microcomputer is one which is capable of operating in its own environment with no dependence on any other device or larger computer.

gaining access to a centralised HIS are:

(1) Visit to the HIS

(2) In-house remote-access terminal

(3) Postal enquiry

(4) Telephone enquiry

The first and second methods can provide immediate response to queries and are most effective when several consecutive queries need to be carried out, which will be a common occurrence.

The first method will be the most frequently used in Korea where the spread of computers is not as wide as in developed countries. It would be used mostly by local users who would require information output immediately and may prove to be the best approach for non-interactive users in obtaining accurate and relevant information.

The second method applies to those users who use the system through their own in-house computer terminals (i.e. ordinary microcomputers) connected to the system via public telephone lines using 'modems'.[5] Users must then frame the questions, interpret responses, and know how to use those responses in their decision making or in directing the search for further information. The user groups in this category would be those who are likely to require information frequently and instantaneously, e.g. large contractors, architectural practices and housing research organisations. The time required to gain access to the system depends largely upon the centralised hardware configuration of the system as well as the number of interactive users wishing to access the system simultaneously. The principal disadvantage of this method is the considerable user training required, concerning both the detailed contents and operational facilities of the system. It is important to remember that the system will be operated by people who have no wish to spend time unnecessarily acquiring programming skills. If the benefits of on-line access are to be firmly established, the system must be as straightforward to use as possible, with simple but comprehensive instructions to guide users through the options open to them at each

5 Abbreviation for 'modulator/demodulator', a device which is used to transmit digital data over telephone circuits.

step.

Users falling into the third and fourth categories must be provided with detailed instructions about the most efficient ways of organising enquiries; this would improve communications between the user and system operator or intermediary and ensure the efficient operation of the service.

Users making postal enquiries would do so on a specially designed enquiry sheet (a query request form), containing a detailed description of the nature of each enquiry. In the absence of direct communication between users and operator, every enquiry must be sufficiently explicit and precise; otherwise, many subsidiary questions arising from the search will remain unanswered, possibly resulting in much relevant information not being retrieved. Consequently, users will not know how much information output they are likely to get back. Another disadvantage is the length of time it takes to send and receive information.

The fourth category, enquiry by telephone, should also prove a popular form of enquiry, especially for simple queries. The user (member subscriber) telephones an enquiry to an operator, who types in the query at a terminal and reads back the results received or sends them to the user by other means.

At present, demand for the interactive use of the HIS will be limited in Korea; certainly, the other methods of information dissemination would be dominant. However, the number of interactive users may be expected to rise as the falling price of computers stimulates their increasing use.

System output may also be dispatched to the user by means of telex, facsimile or computer-based electronic mail systems. Every possible convenience should be provided to users in relation to their access to the service. As the number of enquiries shows a steady increase, the relative number of information intermediaries should increase correspondingly, in order to ensure the continuing swift reply to information requests.

2.2. THE PRESENTATION OF INFORMATION AND METHODS FOR PROCESSING GRAPHICAL INFORMATION

Information must be presented in such a way that will help users to fulfill their principal design or planning tasks. The uses to which different categories of users put information are extremely varied and the system must therefore be able to produce output in a variety of formats which should be immediately useful for the end-user. The criteria for the best format for information disseminated by the HIS will correspond generally to those described in Chapter 2, Section 2. In addition, numerical information should be presented in such a form that no further computation is required of the recipient. A brief written analysis relating to areas of enquiry might also be provided on request. For those who want complete descriptions of a predetermined group, aspect or level of scheme characteristics, information should be available on paper from which photocopies may be made on request. This will help the service operate more swiftly and economically.

The attractive presentation of information output is another crucial factor in determining the success of an information system. Notably, the general tendency to deliver reams of computer print-out should be avoided wherever possible. Users find them confusing and illegible. Instead, the incorporation of graphics, such as line graphs, charts and tables may increase the understanding of users. Simplicity of display and the reduction of output to a (comprehensive) minimum will ultimately help the HIS gain a large measure of acceptance. Certainly, in the field of architecture and associated disciplines, written material is not necessarily always the best means of communication. As elaborated in Chapter 7, written and graphical information (including plans and maps) are complementary in effectively conveying both the concept and detail of a building scheme.

The final phase of information dissemination by the HIS requires all key drawings supplemented by alphanumeric information to be dispatched to the user. Graphical information can be stored or distributed in microform[6] or digitally using electronic networks, or in paper form.

Microfilming drawings (i.e. 16 or 35mm microfilming) is a photographic process which involves the use of cameras and film-developing chemicals, and is currently limited

6 Microform is the generic term for roll microfilm, microfiche, ultrafiche and microcard.

to a maximum input paper size of A3 and A0 for 16 and 35mm formats respectively. The implication is that all drawings to be handled by the HIS should be initially adjusted to those sizes acceptable for microfilming. The cost of a 16mm microfilmer and processor lies in the range, £3500 and £3000 respectively. The 35mm processing costs a great deal more: around £50,000 at the time of writing. Typically, they can operate at around 500 pictures per hour.

Microform may be supplied either as reels of microfilm or as packs of microfiche, and users must be equipped with the necessary machinery to both view information, and to take paper copies of it. Reproduction speeds are typically 10 seconds per paper copy. Both manual and automatic versions of microform readers or reader/printers are available. The automatic version can locate a specified drawing or document using pre-coded indices and may sometimes be linked to a computer. Manual readers cost around £500, whilst automatic reader/printers are in the range, £2500 to £8000.

Drawings may be transformed into digital form by image scanners[7] or digitiser boards[8] connected to special graphics software. They each require considerable computing power since image processing takes up much more storage space than processing alphanumeric data. Whereas the scanning of an input drawing can be completed in a matter of seconds, using a digitiser usually takes much longer since it is, in effect, a manual process. But most scanners require their input to be at most A4 (although A3 and larger machines are now beginning to appear). Digitally stored drawings may be reproduced using plotters or laser printers.

For interactive users to be able to view drawings, they need to be equipped with high resolution[9] terminals costing at least several times as much as ordinary terminals used for alphanumeric display. Obtaining paper copies of drawings also requires access to a plotter or laser printer.

Once in digital form, drawings can be transmitted electronically to remote users via

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7 A device which transforms the contents of documents or drawings into a digital form by scanning them.

8 A device which is used to convert an analogue measurement to a digital form.

9 The degree of fine detail that can be distinguished in a graphic display on a VDU.

the public telephone system, or within dedicated networks,[10] or by telex. However, except where a dedicated network is used, transmitting a drawing of even moderate complexity can take a very long time, in some cases, a matter of hours. Alternatively, digitised drawings (and associated alphanumeric data) can be run off onto magnetic tapes or disks, and distributed as such. Again, each user must have both computer and software compatible with that of the HIS, although formats (such as Graphical Kernel System and Drawing Exchange Format) for drawing transfer along data networks are steadily being standardised, allowing computer graphics to be both read and written on more and more different types of computer system.

Although dependent on the number of housing schemes involved, the most economical method of reproducing drawings will be from photocopies of original drawings, particularly where only a limited number of key drawings to each scheme is involved. However, drawings would have to be standardised in A4 or A3 format in order to allow the use of a standard photocopier and to cope with the physical problem of handling and reproduction.

There are at present many different computer systems and pieces of equipment available from various manufacturers, all varying widely in cost and performance. It therefore proves difficult deciding upon a particular system or mix of systems for the HIS. The further option remains to lease certain systems or to use bureau services[11] for some part of the data processing. Decisions of this nature will, by and large, be related to local conditions but will have to be made with the following principal criteria in mind:

(1) Cost of initial purchase of systems.

(2) Volume of drawing input/output in relation to both input/output speed and unit cost.

Apart from devices for graphical input, there are also a number of devices for text input such as optical mark readers, optical character readers or magnetic ink character readers. They are all well proven methods of data entry, capable of processing several hundred documents per minute, but remain extremely costly and only very large volumes

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10 A data network set apart for private or special use.

11 An organisation which offers centralised computing power ('number-crunching') for outside firms whose own computing requirements are not sufficiently large to warrant their having their own independent system.

of input would justify their purchase. Therefore, for a small scale service involving a relatively a small number of housing schemes, manual data entry to the computer would be, at present, the most economic and practical method of data input.

2.3. INDEXING SYSTEMS FOR DRAWINGS

Drawings for the HIS should be processed in a standard indexing system, preferably one which is known to and popular with prospective users of the service. The drawings required for building applications in Korea normally consist of *location* drawings, which are general plans, elevations and sections of the site, units, building blocks and external works. The full list of statutory requirements is as follows (Table 2):

TABLE 2. Drawings for Building Applications in Korea

Site plan
Plans
Elevations
Sections
Section details
Specifications
* Structural calculations
* Structural drawings
* List of interior materials
* Sewage and disposal facilities
* Landscape plan
* General mechanical and electrical drawings
* Mechanical and electrical drawings concerning fire protection
* Parking plan
* Site contour plan (showing the location of built structures)
* Site section (showing the location of built structures)

Key * if applicable

N.B. 1. In case of public projects, slightly different requirements apply.

2. Drawn perspectives or photographs of models, and/or photographs of the site are normally included in the submission.

3. A concise area analysis (including floor area analysis) is also normally included.

The number of drawings required for a building application is normally less than that for actual construction. Whereas the number of drawings required of a small scale housing project will probably not exceed twenty or so, large scale schemes with, say more than 1,000 domestic units with a variety of unit types, may require up to a hundred drawings for the application. If mechanical, electrical or structural drawings are to be supplemented, the number of drawings might number in total several hundred. Besides the issue over design copyright (described in Chapter 6, Section 3), it is not expected at this stage that such a detailed level of drawn information would be demanded by any prospective user. However, there must be a consistent and systematic structure allowing such a large number of drawings to be indexed and filed for ready access and cross-referencing. No standard rules for indexing drawings are stipulated at present, thus the adoption of an existing system such as CI/SfB drawing indexing system should be considered.

2.4. USER GUIDANCE

The difference between what the enquirer or initiator really needs to know, and the information output from a search, will be proportional to his knowledge of the system. Users should therefore be provided with clear guidance concerning the classification and indexing system, search concepts and terminology of the HIS, together with instructions for assembling these concepts into a proper enquiry. Furthermore, such guidance will both give users a better understanding of their own information needs, and the detailed means by which the HIS can fulfill these needs. In general, guidance will fall into three categories:

(1) Information about the database for interactive users - database producer's manuals and updates, and database newsletters.

(2) A general description of the system (i.e. application programs) for interactive users - system manuals and updates, and system newsletters.

(3) Information about search techniques for all types of users - classification and indexing systems, glossaries and dictionaries, search guides and appropriate newsletters.

For interactive users in particular, instruction and refresher courses should be organised on a regular basis or at times of particular demand. Many lay prejudices in relation to the use of computers can be overcome through proper education and thorough instruction in matters such as computer operation and system capabilities.

2.5. PUBLICISING THE SERVICE

The depth and scope of the HIS must be made known to each potential user. This can be carried out in the following ways:

(1) Professional remedial courses, e.g. Korean Institute of Registered Architects (KIRA) annual remedial charter

(2) Advertisements in professional magazines

(3) Information sheets circulated to potential users and professional societies

(4) Regular introductory seminars

Demonstrations of the system are an important part of creating general awareness of its existence and capabilities. Attracting potential users to exhibitions or demonstrations would be necessary to achieve the necessary subscription level sufficient to finance the service. Demonstrations are often most effective when tailored to a particular group of users. Various presentation media may be used: televisual, film, overhead transparency, slides, tape-slides, etc.

After the initial implementation, in whatever format, the form and content of users' enquiries should be carefully studied with a view to finding potential areas for improvements in the performance of the HIS. Many current information systems and services benefit greatly from analysing the detailed feedback from users. Thus, users should be encouraged to inform the service at every juncture of any complaints or criticisms they may have had with the service.

3. TECHNOLOGICAL OPTIONS IN INFORMATION PROCESSING AND DISSEMINATION

Recently, the sheer rate of technological development in computing has produced a number of uncertainties as to the selection of appropriate systems for a particular need. At the same time, this evolution of information technology creates higher expectations from users than ever before.

The nature and scope of information systems like the HIS are less and less likely to be constrained by the technology available in most countries. Even 10 years ago, the cost implications of computer technology was often a forbidding constraint, preventing the development of many systems that were otherwise conceptually very attractive. Now, with the advent of microelectronics, the cost of computer hardware has fallen sharply, whilst general 'computer literacy' has dramatically increased, allowing ever more complex and powerful software to be developed. Today's microcomputer, at a cost of just £500 or so, has nearly equal capabilities to very large machines costing perhaps a hundred times as much only 10 years ago; to the extent that current developments blur many of the customary distinctions between microcomputers, minicomputers and mainframes. In the latter half of the 1970s, mainframes like the IBM 360 and 370 series or Digital Corporation's PDP 10 and 20 series had approximately 65,000 bytes of main memory [2]. Today, chips storing more than a million pieces of data on a tiny slice of silicon are appearing in personal desk-top computers [3]; likewise, central processing units for large mainframe computers, once the size of a large room, are being condensed onto boards no larger than the average newspaper [4]. Very recently, optical discs have been developed which can store up to 1.5 gigabytes (i.e. 1,500 megabytes) and their capacities will inevitably increase in the next few years.

Considerable effort is also going into making computers faster. Current personal computers can perform over a million arithmetic operations per second, which may be compared to the two mainframes referred to above, which were capable of performing up to approximately 500,000 arithmetic operations per second [5]. Supercomputers capable of performing 10 billion calculations a second, 10 times the current limit, are beginning to appear.

Small computers allowing proper searches through man/machine dialogue (voice technology) may be on the market in the near future, offering further improvements in the aspect of user-friendliness of computers. The rate of technological change and the diversity of access to information which are likely to emerge in the future require us constantly to consider the new possibilities opened up for the best use of information.

In this section, technological options which may influence the form of the HIS in the present and near future are reviewed.

3.1. CONVENTIONAL PROGRAMS VERSUS THE DATABASE APPROACH

There exists a multitude of possible ways and means of developing a housing information system. The form of the system will be primarily based around either the conventional[12] (in-house) program, or the packaged database[13] (off-the-shelf) approach. The former method has the attraction that programs can be tailored precisely to one's needs and made to conform to existing practices and standards. However, this approach is becoming increasingly uneconomical as labour costs for computer programmers rise and software becomes more sophisticated. Similarly, because the time before a system becomes operational ranges from a few months for a simple system to several years for a complex system, there is the further problem of inflexibility in coping with any newly arising needs. To take an instance, a seemingly uncomplicated system such as the Building Cost Information System (BCIS) of the Royal Institution of Chartered Surveyors (RICS, UK) took three professional programmers a full year to complete and set up and had cost around £100,000 by early 1984 [6]. Costs will of course vary from country to country: in Korea, where labour costs are relatively low and working efficiency high, one would have expected this final bill to be much lower. Nevertheless, packaged database systems nowadays provide an increasingly attractive means of storing and retrieving data at relatively cheap unit cost, given their ever increasing capabilities, often surpassing conventional programs in overall performance. There are three principal designs of database systems: hierarchical, network and relational. Although relational databases have become the focus of the current trend of database applications, they are not necessarily best suited to all applications. All three differ in their ease of implementation and use, and in their relation to user concepts and organisations.

3.2. EXPERT SYSTEMS

Expert systems are a major area of the research field known as 'Artificial Intelligence' (AI). An expert or knowledge-based system may be described as the representation within a computer of human expertise (generally drawn from a very limited field) stated in the form of simple IF...THEN... rules, enabling the machine to offer advice or take

12 A purpose-built program designed to suit the special requirements of one user or user group.

13 A generalised program or collection of programs written to cover the possible requirement of many users.

decisions within the field by making logical inferences from the facts of a given situation or circumstance [7].

The expert system is substantially different from the conventionally programmed system in its representation of heuristic knowledge, its facility to draw inferences, to focus a search, to ask relevant questions of a user, to cope with degrees of uncertainty or missing information, and its ability to explain its own reasoning (inference chains). It consists of three primary elements: a knowledge base; the model of the current problem situation; and a controlling knowledge manager matching in-built knowledge against the given facts [8].

An expert system may simulate natural language communication (input/output) showing the rule on which it is currently working if users are unclear as to why a question is being put to them. It may ask the user new questions, similar to those asked by the user, and may make suggestions to the user about information relating to the question, but not explicitly contained in the question. The following dialogue is based on the known capabilities of expert systems applied to a typical session with the HIS:

|
| (Operator explaining his initial brief to the system)
|
User : Is this the maximum density I could get?
System : Is the building form of 5 storey blocks with the present mass compulsory?
User : Not necessarily.
System : Then, ten 3-storey terraced houses in a parallel low may give you 10% greater density. The particular details are ~ ~ ~ . The generic schemes meeting these requirements are ~ ~ ~ .
|
| (System displays aerial views and plans of the schemes.)
|
User : Would it cost me more?
System : No. However, there might be + or - 2% cost fluctuation within the next 3 months according to the forecast by the Construction Cost Indices published this month of August 1987.
|
|

Some expert systems appear highly intelligent and clearly take a long time to develop. Such systems are usually very expensive and require considerable computing resources since expert knowledge together with exhaustive reasoning (taking account of various query situations) have to be both processed and stored.

The earliest applications of expert systems were limited to areas such as 'guessing' complicated organic molecular structures and in the medical diagnosis of certain conditions. However, areas of use have consistently been opening up, owing much to the emergence of higher level languages such as Lisp and Prolog. Nowadays, expert system 'shells' have become available enabling users to construct their own expert systems much more easily than writing them from scratch in some low level programming language. In the building and construction fields, some expert systems (mostly using shells) are used in areas such as the selection of plant for multi-storey projects and the diagnosis of the causes of dampness in buildings [9].

Although at present expert systems in the building and construction fields are still mainly at the development stage, they remain a technological possibility which any future implementation of the HIS must take into consideration. This would however, inevitably necessitate rather different operational groundwork to that presented in this thesis.

3.3. THE STORAGE AND COMMUNICATION OF DIGITAL INFORMATION

There are yet further technological possibilities relevant to any implementation of the HIS: in particular, the various new data storage media currently in use and being developed, notably, the compact disc and the viewdata.

The compact disc (CD) is beginning to emerge as a cheap and reliable medium of storing very large amounts of digital information. Unlike floppy discs, current laser compact discs (CD-ROM) do not permit users to record or erase information on their own. However, a single disk, the size of a conventional disc, can store 550 megabytes of data, the equivalent of 1,500 floppy disks or a quarter of a million pages of typewritten text. It may also carry graphics, sound, and even moving pictures in colour. It means that the information on 27,500 housing schemes analysed to the proposed 5 levels can be stored on a single compact disc. The BBC's Domesday project is one example of the possibilities opened up: 9,000 sets of statistics, 50,000 photographs and 60 minutes of moving pictures and sound are all stored on a 30 centimetre laservision videodisc [10], costing the user only £230. Admittedly, hardware costs currently run at about £3800 but attempts are being made to bring this down. There is also a proposal to replace the 30 centimetre disc with a smaller and easier to handle 12 centimetre CDI (Compact Disc Interactive) by 1988 [11].

The distribution of compact discs, by themselves, does not allow for the incorporation of an information intermediary into the information search process, but this may be alleviated by incorporating effective user-friendly facilities into the discs or by adding alternative means of communication with the information intermediary.

Viewdata systems, which in contrast to teletext is fully interactive, can transmit text and graphics stored in computer databases, via the telephone network, for display on ordinary television screens. The British Telecom Prestel service (launched in 1979) was the first attempt to bring this technology to the mass of business and domestic customers. With a Prestel television set (or Prestel adapter fitted to a normal television set), it is possible to call up the central Prestel data bank via the national telephone network. In France, this technology has infiltrated into the ordinary life more than any other country. By subscribing to Minitel [12], the government sponsored viewdata system, subscribers (currently about three million) can calculate taxes, send a complaint to city hall, get help with a child's homework, have a letter translated, and so on. Currently, a more technically advanced system is being prepared, primarily for the business sector. The British Epnitex company is planning to integrate database with electronic mail facilities and offer more advanced facilities for text and graphics editing than currently available on Prestel, together with offering firms the chance to have their own individual viewdata systems; one of its services, Epnilink, will connect different offices or branches with a localised communications system [13]. Seen in the context of the HIS, this would offer the advantage of allowing effective interactive consultation with the central service during the search process. The implementation of the HIS on viewdata systems in developed countries is by no means unrealistic.

3.4. INTERNATIONAL DATA NETWORKS

International communication networks working through packet switching (e.g. European Euronet-Diane, British IPSS, American Tymnet and Telnet) and satellite links (e.g. Satellite Business Systems) are also on the increase. International standards networks such as International Services Digital Network (ISDN) will be in public service from about 1995, which will allow users to connect to anywhere in the world through the standard telephone lines, without any intermediate medium such as a modem being required [14]. Technological innovations continue to make these long distance data networks cheaper and more accessible. In view of this trend, an international network for the HIS becomes a conceivable proposal, coordinated perhaps through some suitably involved international organisation such as the International Union of Architects (UIA) or the International Council for Building Research, Studies and Documentation (CIB).

CHAPTER NINE

COST ANALYSIS FOR THE H.I.S. IMPLEMENTATION

The cost of implementing the proposed service will be dependent upon the overall scale of the service, and the chosen computer systems and methods of information dissemination. It is thus critically dependent upon who will implement the service as there are different existing computing capabilities, channels and methods of data handling unique to each potential organisation suitable for the implementation.

In this chapter, however, the cost of the implementation is measured on the basis of a new independent organisation for a small but self-sustainable scale service, so that any savings arising from any existing facilities and resources belonging to each candidate organisation may be offset against the guide costs presented below.

1. THE LIMITATIONS OF CONVENTIONAL COST-BENEFIT ANALYSIS

The cost-benefit analysis for an information service typically relates costs incurred in its development and implementation to improvements in the efficiency and quality of task derived from its subsequent use. Thus two separate analyses are first required before they can be usefully compared and correlated. However, whilst the costs of development and implementation of a service can be estimated quite accurately, the overall benefits resulting from its subsequent use are not at all easy to assess.

A conventional cost-benefit calculation with respect to the HIS would begin with an investigation into the expenditure of the housing industry on the professional services of the practitioners concerned, and the proportion of that expenditure on their information activities. Subsequently, an assessment of the time saved by the use of the HIS in searching for relevant information and any tangible improvements in quality of work could be attempted in strict monetary terms. However, the obvious and critical shortcoming of this approach lies in the simple impossibility of properly measuring the monetary value of 'pure' information.

The importance of using analogical feedback information in the design process has been elaborated in Chapter 4; and Chapter 5 has described the potential benefits which may be gained from the establishment of a service providing such information. The inference drawn from these two chapters suggests that such an implementation will in fact prove worthwhile, in view of the sheer magnitude of resources and professional services expended on the housing industry. However, we can have no accurate figure for the extent to which feedback information gained from the appraisal of buildings in use is actually searched for by designers and others. Neither do we know exactly how they appreciate the value of such feedback, particularly in relation to the difficulty with which it is acquired. Although many maintain that they appreciate the importance of such information, the true needs cannot be judged by taking such claims at face value. Thus, if we are forced to measure the benefits of such information in purely monetary terms, we have unavoidably to apply a number of uncertain conjectures to the estimation formulae, the results of which are then unlikely to be, in any way, sound or realistic.

A further shortcoming with conventional cost-benefit analysis lies in the assumption that the information is going to be well communicated, and therefore, that users will be in a position to use it effectively. As identified in Chapter 2, there are many conventional problems of communication between information providers and information users, which may equally apply to any implementation of the HIS.

It is not an immediate concern of this study to attempt benefit analysis in purely monetary terms. Instead, the concern here is to investigate the cost only of the initial setting up of the service, and to explore whether the cost would prove a major deterrent to launching the service.

The following cost analysis outlines the approximate economics of the proposed service based on the use of current information technology. The result of this analysis may reasonably be weighed against the potential benefits described in Chapter 5.

2. IMPLEMENTATION COSTS FOR THE H.I.S.

If an existing organisation is to be selected for the implementing body, we might expect a generally reduced initial cost of implementation, due to the possibility of using existing resources as well as the provision of well-established channels of communication with prospective users. The extent of such savings will, needless to say, differ from one organisation to another. Costs will certainly be affected by the decision either to purchase or lease the necessary computer systems, or whether a bureau service is to be used. Many of the more mundane human tasks can also be passed on to established data bureaux, e.g. data preparation and entry or, if necessary, microfilming. Decisions such as these will greatly influence the organisational and managerial form of the HIS and ultimately, its cost-effectiveness.

The cost analysis here is, however, based on three assumptions. First, it is based on an implementation by a new independent organisation, with no consideration of savings from existing resources. When considering one or more (in the case of joint venture) existing organisations, the potential cost savings made possible by the use of existing resources should be offset against the estimates presented below.

Secondly, the implementation costs will also be affected by the overall scale of implementation. It is generally presumed that any kind of information service should be developed in phases, responding efficiently to the demand and changing requirements of users. In this respect, the cost analysis here is based on an initial, small scale but self-sustaining service.

Lastly, any cost analysis will be affected by changing technology, a factor particularly significant in the volatile world of computing. Thus, although the cost analysis presented here is based on current technology, individual costs should not be taken as absolute, but rather as an indicative range.

2.1. SYSTEM REQUIREMENTS

The performance and capabilities of a computerised information service are certain to depend upon the chosen mix of subsystems and machines. There are a great number of computer systems, varying considerably in price, performance, and required back-up (in terms of operating staff). The primary consideration for the selection of systems should be the method of processing graphical data (i.e. drawings). For the establishment of a new organisation at a relatively small scale, it is assumed that the most economic and practical way of storing and retrieving graphical data at present is by the use of microforms. Nevertheless, for the interactive user to identify the schemes of his or her interest as quickly as possible, it is necessary to allow interactive graphical display of at least a few essential drawings, even at low resolution. These two suppositions then necessitate the use of both a microfilm device (including microfilmer, processor and reader) and graphics hardware and software. The selection of a database management system should be based on the data specifications described in the two preceding chapters. Taking all these into account, and assuming the life span of a computer to be a minimum of 5 years, the basic criteria for selecting a computer system are:

(1) The system should be able to integrate a graphics system and a microfilm reader (i.e. automatic retrieval reader).

(2) The system should be capable of handling 90 megabytes of data, 60 megabytes for alphanumeric and 30 megabytes for graphical data. This is based on 3,000 housing schemes being stored for the first five years of the service, with each scheme involving alphanumeric data at five levels of analysis and graphical input of a site plan in medium resolution.

(3) When considering the growing number of interactive users expected at the end of the first five years, the system should allow for as many as eight simultaneous user-interface lines.[1]

Based on these considerations, the initial system configuration for a small scale implementation would incur the following costs (Table 1):

1 This means that the system should be capable of allowing the use of up to eight interactive users at the same time.

TABLE 1. System Requirements and Attendant Cost

(Cost Unit: 1,000 Korean Won)

System Requirements	Cost
Computer and associated equipment	
central processor (allowing 8 lines interface) tape streamer backup main disc	52,000
VDUs	1,950 (five required at 390 each)
modems	2,600 (initially four required at 650 each)
laser printer	3,900
Graphics systems	
graphics system	3,900
digitiser board	3,900
Microfilm equipment	
16mm microfilmer	4,550
processor	3,900
automatic reader (with built-in printer)	6,500 (two required at 3,250 each)
Software	18,200
TOTAL	W101,400,000 (=£78,000 *)

N.B. * Based on an exchange rate of £1 to W1,300.

Prices quoted are based on detailed estimates provided by manufacturers and were valid as at July 1987. These estimates are likely to be similar throughout the world. The effective operating life of the equipment is estimated to be five to ten years, and thus the average annual capital depreciation rate would be in the range of W10,140,000 to 20,280,000 (= £7,800 to 15,600).

2.2. DATA PROCESSING AND STAFF REQUIREMENTS

The basic procedure for data processing may be summarised as follows:

(1) Data Preparation : collection of source material; taking-off and transcription of data; and, data entry and microfilming of graphical data.

(2) Information Retrieval : information-needs counselling; and, information retrieval.

(3) Information Dissemination : sorting and collating of information output; and, packing, addressing and posting.

The procedure begins with the collection of documents and drawings used for building application purposes, which are the major sources of Levels 1 and 2 data. Having been taken off by means of desk appraisal and measurement (partly manual and partly by using a digitiser), the data is transcribed into a standard form[2] from which the data may be entered into the system, in either on-line or batch mode.[3] The rest of the data (i.e. Levels 3 and 4 data) is collected on a standard form for which little interpretation is required by the data entry staff. Level 5 data is also collected on a standard form by scanning building and housing related magazines, in order to provide onward referral for information which may not be covered by the system. Data verification occurs at the point of data entry.

Graphical data (i.e. a site plan) for screen display is automatically stored in the system when the digitising process for area measurement is carried out. Microfilming for drawings, maps and specifications is also carried out.

Updating of the data stored in the system and on microfilm will be made whenever changes occur to the housing schemes contained in the system.

Upon data entry to the system, information searches will be carried out on the schemes stored in the system, which may involve information counselling to enquirers. Information output may be printed out using a laser printer (for both alphanumeric information and digitally stored drawings) or a microfilm printer (for microfilmed drawings, maps and specifications).

The final stage of data processing, particularly for non-interactive users, involves sorting out and collating the output, followed by packing, addressing and finally posting to the user.

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2 The standard form here will be different from the Form of Housing Appraisal and Measurement in Appendix D, and will have a structure designed to facilitate data entry to the system. The development of this structure however, is not an immediate concern of this study.

3 On-line data input refers to interactive input, whereas batch data input refers to input through a card reading machine for punched cards. Batch data input is becoming increasingly rare. However, it is still widely used in Korea, especially for large quantities of data input.

Whilst hardware and software costs move ever downwards, staff costs constantly increase. A small scale operation may be carried out using only a few staff, with no clear divisions of labour, but large scale implementation would require much greater specialisation, for example, system analysts and programmers, computer operators, data entry personnel and database administrators.

As suggested for data processing procedures, a clear division of tasks will normally require staff positions as shown on the left-hand side of Table 2. Numbers to the right of the table indicate staff requirements for a proposed small scale implementation during the first five years and their corresponding salary levels.

TABLE 2. Staff Requirements and Attendant Salary

(Cost Unit: W1,000)

Position	No. of Staff	Annual Salary *
Director:	1	12,000
Receptionist:	1	3,000
Data collection staff:	1	2,400
Data preparation staff:	1	2,400
Clerical staff: addressing, packing and posting	1	2,000
Computing staff:		
data entry staff	1	3,000
system analyst		
system programmer		
computer operator (=application programmer)		
database administrator	1 **	6,000
Information intermediary:	2 ***	14,000 (two at 7,000 each)
Microfilm staff:	1	3,000
TOTAL	10 persons	W47,800,000 (=£36,770)

N.B. * The gross figure, including general insurances and pensions.
** Doubles with the the role of system analyst.
*** Assumes the roles of programmer and operator.

Some cost allowance should be made for training staff in the nature and standard procedures of the work to be carried out. Two or three days would be a reasonable estimate for non-technical staff, i.e. receptionist, clerical, and data collection and preparation staff. In view of the crucial role of information intermediary, persons holding at least a university degree in architecture, or its equivalent, will be required. For prospective information intermediaries with no previous experience in computing to assume the combined roles of computer operator and applications programmer, a training period of at least one month would be necessary to bring them to the level of writing workable programs. This estimate is based on the use of a packaged database management system of moderate complexity, such as SIR or ORACLE. The cost incurred in job training will be calculated at the usual salary rate. Thus, a month's salary for each of the information intermediaries and one-eighth of a month's salary for the rest of the staff should be allocated to staff training before the service can become operational. This would amount to approximately W1,519,000 (= £1,170).

2.3. DATA PREPARATION

The service cannot become fully operational until the analysis teams have accomplished the initial data preparation. Primary trials have shown that data preparation[4] could require, on average, the following man-days which are based on an 8-hour working day (see Table 3):

TABLE 3. Time Requirements for Data Preparation

(Unit: schemes per man-day)

Levels of Analysis	Taking-off and Transcription of Data	Data Entry *
1	8	32
2	2	8
3	16	16
4	16	16

N.B. * Based on on-line data entry.

This estimate is based upon the following assumptions:

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4 An estimate for Level 5 data preparation is not given here since the volume of Level 5 data required for each housing scheme, however small, will vary to a great extent. In practice, only a small proportion of housing schemes (to be contained by the system) would receive published coverage, with the overall level of coverage varying greatly from scheme to scheme.

(1) Length and area measurement for Levels 1 and 2 analyses is carried out by using a digitiser. Site plans are stored in the computer through this procedure.

(2) Levels 3 and 4 data are collected in a standard form for which little effort of data transcription is necessary.

(3) The time required for data entry includes the time for data verification.

Assuming there are 1,000 housing schemes for the initial input, each level of data requires, respectively, 125, 500, 63 and 63 man-days to be taken off from source documents and transcribed onto a standard form of measurement from which data entry may be carried out. On-line data entry for the first two levels requires approximately a quarter of the time required for taking off and transcription, suggesting that 32 and 125 man-days, respectively, should be allocated. The data entry for levels 3 and 4 would require approximately 63-man days each. These would make the employment of additional staff inevitable, in order to minimise the time incurred in initial data preparation. In view of the specialist nature of this work, the temporary employment of architectural students is recommended.

For the taking off and transcription of level 1 data, temporary employment for 10 architecture students for 12.5 days would be adequate. For the other data levels, 50, 6.3 and 6.3 days, respectively, should be allocated. Estimated costs incurred in the taking off and transcription of data for 1,000 schemes by employing students are shown in Table 4.

TABLE 4. Costs of Data Taking-off and Transcription for Initial 1,000 Schemes

(Cost Unit: W1,000)

Levels of Analysis	Taking-off and Transcription of Data	Cost *
1	125 man-days	750
2	500 man-days	3,000
3	63 man-days	375
4	63 man-days	375
TOTAL	751 man-days	W4,500,000 (= £3,460)

N.B. * Based on a daily wage of W6,000 (=£4.60) per part-time student.

For the increased efficiency of the operation, senior architecture students may be preferable. For further acceleration of data preparation, more part-time employment may be necessary, with more digitisers being leased or rented from commercial bureaux or equipment dealers.

For batched data entry, based on the standard 80 column punch card, each level of a housing scheme requires, on average, 25, 100, 50 and 50 punched cards respectively. The current rate for key punching by bureau services is W22 (= 1.7p) per card and this includes the cost for data entry to computer [1]. At this rate, the estimated costs for data entry of 1,000 schemes are shown in Table 5.

TABLE 5. Costs of Data Entry for Initial 1,000 Schemes

(Cost Unit: W1,000)

Levels of Analysis	Number of Cards Required	Cost
1	25,000	550
2	100,000	2,200
3	50,000	1,100
4	50,000	1,100
TOTAL	225,000	W4,950,000 (=£3,810)

Roughly similar cost levels will apply for interactive data entry. With regard to drawings, an estimated average of 40 drawings per scheme would be required to be microfilmed; thus, 40,000 drawings will be microfilmed for the initial 1,000 schemes. The time required for a 16mm microfilmer to deal with such a quantity works out at 20 man-days (based on 250 pictures per hour), requiring one month's salary for a full-time microfilming employee (i.e. W250,000 or £192).

In total therefore, an initial capital outlay of approximately W9,700,000 (= £7,460) would be required to prepare the initial data for a sample of 1,000 housing schemes at four main levels of analysis.

After the initial input, the permanent staff will be capable of inputting 8 schemes per week, at all four levels. Thus, by the end of the first five years of operation, the total number of housing schemes would amount to 3,000.

The costs estimated above may be significantly reduced if the service is implemented in stages involving initially Level 1 data and drawings. In this case, an initial capital outlay of approximately W1,550,000 (= £1,190) would be adequate and the data may reasonably be prepared within a relatively short time period.

2.4. FIXED COSTS AND OVERHEADS

Fixed costs will be required for office accommodation, general office equipment and services, as in Table 6.

TABLE 6. Costs of Accommodation, General Office Equipment and Services

(Cost Unit: W1,000)

Accommodation, General Office Equipment and Services	Cost
Accommodation *	12,000
Office equipment, i.e. furniture, filing cabinets, drawing boards, etc.	2,000
Special equipment, i.e. typewriter, photocopier, sound-level meter, etc.	1,200
Electricity, HVAC, cleaning, etc.	3,600
TOTAL	W18,800,000 (=£14,460)

N.B. * Approximately 1,440 sq.ft. of office space would be required, the estimated annual rental being W10,000 (=£7.70) per sq.ft. at sub-city centre rates.

A true costing will take account of the overheads of running the service. However, they are the least predictable cost items at this time since some are dependent upon the volume of information enquiries which may only be known after the service has been operational for a certain period of time. No attempt is made here to estimate such items but, nevertheless, cost allowance should be made in the following areas, as shown in Table 7.

TABLE 7. Overhead Costs

(Cost Unit: W1,000)

Overheads	Cost
Consumables for computer processing and microfilming	*
General travelling expenses	1,200
Subscription to periodicals (approx. 40)	1,000
Publicity	1,000
Stationary, telephones and postal expenses	*
Sundries	600
TOTAL for Estimable Overheads	W3,800,000 (=£2,920)

N.B. * Inestimable at this time.

2.5. TOTAL COSTS SUMMARY

Lastly, the total costs for initial set-up and the first year operation of the proposed HIS can be summarised, as in Table 8.

TABLE 8. Summary of Total Estimated Costs

(Cost Unit: W1,000)

Cost Item	Estimates
Computer systems and microfilm equipment	109,200
Job training	1,519
Initial data preparation for 1,000 schemes	9,700
Annual staff salaries	47,800
Accommodation, general office equipment and services	18,800
Annual overheads (of items estimable at present)	3,800
TOTAL for Initial Set-up and the First Year Operation	W190,819,000 (=£146,780)

It can be seen that the costs of setting up and operation of the service are small when we consider the scale of potential benefits of the service - even though these benefits are not explicitly quantifiable. Fears about the need for vast investment in the establishment of a computerised information service need no longer apply to any implementation of the HIS. The cost analysis presented here suggests that the HIS could be financially viable, and should give proper incentive to interested organisations, including the government. This holds particularly true for any joint venture implementation, where the development costs would be shared out. Furthermore, the rate of current developments in information technology seems likely to ensure the increasing economic viability of the proposal.

3. CHARGING POLICY

It is difficult to decide how much to charge users for the information provided by the HIS. Above all, the acceptable charge for the service is fundamentally dependent on the environment in which the service will be operated, as the value of information is appreciated differently in different environments.

Certainly, the best approach would be initially to charge users an acceptable level and gradually increase the charge to a full economic rate over the years of development, as the full benefits of the service become apparent. But the range of acceptable charges is likely to be very difficult to estimate. Moreover, there is evidence that architects are unfamiliar with the current costs of obtaining information, tending generally to underestimate them.

There are some kinds of information in the construction industry which may attract particularly high demand, such as tender and contract information, knowledge of which may be critical to selling one's services and products. Examples of information services for these kinds of information do not exist in Korea. But, building information services in the UK, such as, for example, ABI, GLENIGAN or Contract Leads, are able to charge commercially viable rates for their information, i.e. in the range of a few hundred to a few thousand pounds. They are all profitable. This would not, however, be the case with the housing information proposed here; and there is no precedent information service of a similar nature either in Korea, or any other country, which could offer a reasonable yardstick for the assessment of acceptable charges for the proposed service.

The likely level of charges for the use of the HIS would be higher than what users currently feel ready to pay, since many users are not accustomed to paying a realistic price for their information. Architects habitually regard information as something like a free commodity, to be regularly volunteered by product salesmen. Besides, there are no standard methods for measuring the time effort spent on collecting feedback information similar in nature to that of the HIS. Even where particular difficulty has been encountered in locating relevant feedback information, this is rarely, if ever, assessed in strict money terms.

With users clearly unwilling to accept the real cost of information product, some way of sharing costs between individual users, interested organisations and (hopefully) the government, would seem to be necessary in the first few years in order to launch the project. This might also have the advantage of emphasising the co-operative nature of the project. It would become necessary to change traditional attitudes about information (for example, that it should be freely available to users), perhaps by means of extensive educational campaigns aimed specifically at the construction industry, to create a greater awareness of the existing costs of information gathering.

Apart from external financial support, an annual income will be generated in the form of members' subscriptions. Such subscriptions could be established either, on a scale which would take into account the housing design 'turnover' of the organisation concerned, or at a rate related directly to usage, method of access to the system, the time when the search took place, the duration of the search (computing time used), and the volume of information product generated therefrom. Eventually it is hoped that the system will be self-supporting.

CHAPTER TEN

POTENTIAL IMPLEMENTING ORGANISATIONS AND IMPLEMENTATION STRATEGIES FOR THE H.I.S.

The eventual uses and expected benefits of the HIS are, to a large degree, dependent on the manner of its implementation, which will in turn inevitably be linked to the working characteristics of the implementing organisation.

This chapter is devoted to detailing potential implementing organisations and the general implementation strategies for the proposed HIS in Korea, with particular emphasis on their involvement in housing information affairs and associated capabilities for data acquisition and information dissemination.

1. POTENTIAL ORGANISATIONS FOR THE H.I.S. IN KOREA

In the survey conducted by the Korea Research Institute for Human Settlements (KRIHS) on attitudes towards the establishment of a comprehensive housing data bank [1], a small sample of housing related practitioners were asked to state whom they would prefer to organise the service. They gave the following order of preference (Table 1):

TABLE 1. Preference of Organisation Type for Housing Data Bank

Organisation Category	Preference
Government sponsored organisation	65%
Central government	20%
Private organisation	10%
Public organisation	5%

SOURCE: KRIHS, "The Study on the Improvement and Effective Utilization of Housing Data System" in Housing Policy Development Research, Seoul: KNHC, August 1983.

The principal concerns underlying the above results have been, for the most part: an apprehension about the collection of data (sampling rate); the reliability of the service; and its cost in use. Another reason for the marked preference for a governmental organisation is that such an organisation would be in a better position to supervise necessary conventions such as the standardisation of a vocabulary and classification of data.

The above survey results are not directly applicable to the HIS, as the data bank proposed by KRIHS was simply a statistical database and the sample informants were, by and large, restricted to planning professionals. However, informal interviews by the author with a small sample of Korean architects, both in the public and private sectors, have shown a similar response.

Potential organisations for the proposed HIS in Korea may be categorised as follows:

(1) Government and public organisations :

- Bureau of Housing in the Ministry of Construction
- Korea National Housing Corporation (KNHC)
- Korea Research Institute for Human Settlements (KRIHS)
- City of Seoul

(2) Voluntary and professional organisations :

- Korean Institute of Registered Architects (KIRA)
- Construction Association of Korea (CAK)
- Housing Information Centre of Korea Housing Association (KHA)

- Korea Institute of Construction Technology (KICT)

(3) Private companies :

- Various types of publishing houses or information services relating to housing or architecture.

1.1. GOVERNMENT AND PUBLIC ORGANISATIONS

1.1.1. BUILDING APPLICATION PROCEDURE

It is necessary to review how documents and drawings for building applications (i.e. the primary data source for the proposed Levels 1 and 2 of housing analysis) are handled in government and public organisations. Initially, they are filed with the local authority concerned, and the information extracted from them passed through government channels in the form of housing statistics. The Department of Architecture of the Bureau of Housing in the Ministry of Construction is ultimately responsible for the final preparation of statistics concerning building warrants and construction starts.

Any new construction, alteration, change of use or major improvement of a building over a certain size requires a permit from the local authority concerned. An application for warrant to erect residential buildings is made to the *architectural* or *housing* department of the local authority concerned. There are two types of application, depending upon the size and form of a proposed housing scheme: i.e. application for 'Consent' for a scheme of 20 or more dwellings and application for 'Permit' for a scheme of under 20 dwellings. An application for Consent goes through a stricter examination at a higher level of authority than an application for Permit. In addition, applications for Permit and Consent require different sets of documents to be submitted to the local authority concerned. Each application for a building Permit/Consent for a housing development should comprise (Table 2):

TABLE 2. Requirements of An Application for Building Permit/Consent for A Housing Development

Requirements *	Permit	Consent
Application forms	1	1
Certificates of site ownership and land registration	1	1
Plans	1	1
Documents for site development	2	3
Public holding certificate	2	3
Public utilities and services plans	2	1
Comprehensive plans and associated documents	2	3
Certificate of eminent domain	2	3

Key 1 (necessary), 2 (not applicable), 3 (if applicable)
N.B. * Many of the above requirements may be exempted for public projects.

Currently, Korea consists of 1 special city (Seoul), 4 greater cities and 9 regions (and their subordinate 57 cities). Each city or regional council comprises several boroughs or district councils. The administrative zoning of Korea is shown on Fig. 1.

FIG. 1. Administrative Zoning of Korea

The hierarchical structure of central and local government authorities[1] involved in housing Permits/Consents is as follows (Table 3):

1 There are regional variations in the names for directorate, department and section in charge of house-building warrants. For public housing development by KNHC, applications for permits are made to the local authority concerned, and those for consents to the Ministry of Construction.

TABLE 3. Housing Permit/Consent and Related Local Authorities

- MINISTRY OF CONSTRUCTION
  Bureau of Housing
  Dept. of Architecture
  - SPECIAL OR GREATER CITY
    Directorate of Construction
    Dept. of Housing
    - BOROUGH COUNCIL
      Directorate of Construction
      Dept. of Housing or Arch'ure
  - REGIONAL COUNCIL
    Directorate of Construction
    Dept. of Housing
    - DISTRICT COUNCIL
      Dept. of Construction
      Regional Plng. Sect.
    - METROPOLITAN CITY COUNCIL
      Directorate of Urban Plng.
      Dept. of Housing
      - METROPOLITAN DISTRICT COUNCIL
        Dept. of Arch'ure
        Arch'l Sect.

A great deal of information is contained in the application documents and its subsequent Permit/Consent, which is sufficient to provide most of Level 1 and part of Level 2 data requirements with no further manipulation. The remainder can mostly be taken off from drawings accompanying the application documents. The legal requirement for the storage of files and drawings is ten years for the local authority initially concerned with building warrants. However, the files on larger and more significant projects, e.g. high-rise and large scale housing, are stored in archive permanently.

Upon the acquisition of building warrant, there are further official procedures to be gone through before the building can be occupied. These are notification of the start of construction, interim inspections and their certification, application for amendment of warrant (if necessary), and the notification of completion of construction and its subsequent certification.

1.1.2. ORGANISATIONS IN THE PUBLIC SECTOR

Considering the ease of access to the official documents filed with local authorities, a small number of public organisations emerge as potential candidates for the HIS implementation. Their current roles, organisational structures and involvement in housing information affairs are briefly introduced here, together with any information services currently operated by them.

The **Bureau of Housing** in the Ministry of Construction has a major responsibility for housing affairs in the country. It consists of four departments: Housing Policy, Housing Administration and Management, Architecture, and Technical Advisory departments. Many of their routine tasks and responsibilities are related to the operation of the HIS, for example, surveys and research into residential environments and subsequent preparation of statistics on housing conditions. The bureau is also in a position to co-ordinate the conventions which may be necessary for any national scale implementation of the HIS.

As a government sponsored organisation established in 1962, the **Korea National Housing Corporation** (KNHC) is roughly equivalent to the Scottish Special Housing Association (SSHA) or to the UK New Towns Corporation. It develops large housing estates and new towns comprising houses and flats for both sale and rent, and, in some cases, those built in trust. Between 1980 and 1984, it built some 36,000 dwellings annually, representing from 28 to 59% of the annual public sector housing production, and equivalent to 14 to 30% of the national housing product during that period. For 1985 and 1986 it has aimed to provide more than 30% of public sector production, or over 14% of the national total [2].

KNHC carries out regular surveys on rent levels, residential conditions and behavioural patterns of urban dwellers. The surveys are carried out by its seven local branch offices throughout the country, each supervising a number of on-site management offices for housing estates developed by the KNHC.

Within the KNHC, there is Housing Research Institute which is concerned with research on energy-conscious building, new building methods and technology, modular co-ordination of building materials and components, and so on. The institute maintains a library, which is open to the public, but there is as yet no proper implementation of an information service. Whilst the KNHC introduced some measure of computerisation in late

1979, the only area in architecture where computers are presently used is in the measurement and costing of building quantities.

The potential of KNHC for the HIS is undoubtedly high considering the wealth of data in its possession and its chain of local branches which could be employed for data collection for the proposed service.

Established as a government sponsored R & D organisation, the **Korea Research Institute of Human Settlements** (KRIHS) provides expertise on urban and regional planning, transportation planning, land use planning and housing policy. Although its concern with housing is limited largely to land use and economics, KRIHS exists as a potential candidate for the HIS because of the expertise it has already accumulated, and for its involvement with the physical aspects of housing. It offers an information service through various media: reports, regular newsletters and digests; and a computerised data bank is currently being operated.

The **City of Seoul** presents itself as a conspicuously viable candidate, particularly as a starting point if the service is to be implemented in stages. According to the 1986 Census [3], nearly 10 million people (one quarter of the nation's total population) reside in an area of some 240 sq.miles, which is less than 1% of the land area of the country. Furthermore, 80% of the commerce and trade, 50% of the higher education facilities, and 40% of the medical facilities of the nation are concentrated in Seoul and her immediate vicinity. It is precisely the concentration of both housing (over 30% of the national total) and prospective user population (over 50% of all potential user firms and individual users) in Seoul and its adjoining Kyungki region which underlines the city's potential for the HIS implementation.

Although building permits and consents come under the jurisdiction of each local borough council, in reality, nearly all developments subject to consent are examined by the city. If the service is implemented by the city, ease of data acquisition for the HIS is ensured. The city is not however concerned with information services, and computerisation has not as yet been introduced to architectural or housing affairs.

There remain further (lesser) candidates, such as the Bureau of Statistics in the Economic Planning Board (EPB), concerned with population and housing census, and the Directorate of Research in the Korean Housing Bank which is concerned with housing economics. However, their concerns with housing information are not really sufficient in the light of the service envisaged.

Building research organisations such as the National Construction Laboratory Institute (NCLI) of the Ministry of Construction may also be considered as candidates. However, as their principal concern is with construction techniques and the specification and testing of building materials, their potential for the HIS implementation is considered rather weak.

1.2. VOLUNTARY AND PROFESSIONAL ORGANISATIONS

There are a number of voluntary and professional organisations concerned with housing and construction affairs. Although the information requirements and processes within each are unique, they all collect necessary housing data from clients, architects and developers involved in new housing developments. The form of data collected is largely identical with that for official requirements, but is accompanied by a proprietary document specific to each organisation.

The following organisations are considered as potential candidates and their involvement in housing and housing information described:

The **Korean Institute of Registered Architects** (KIRA) is a professional body whose function is broadly equivalent to the UK's RIBA or the American AIA. Architects are required to have their building applications examined by one of the thirteen regional branches of the KIRA before being submitted to the local authority concerned. The KIRA had until recently kept a copy of each building application on archive, but has lately abandoned this practice because of storage difficulties.

KIRA is a strong candidate, considering its well established communication channels with architects and its responsibility for professional expertise.

It is the publisher of the *Journal of KIRA*, a monthly magazine similar to Architect (formerly the 'RIBAJ') or Architecture (formerly the 'AIAJ'). KIRA is actively involved in housing related research, and organises design competitions in special areas such as energy conservation. It maintains no formal information service. Computerisation has not yet been introduced, but is being considered for the management of records of registered architects.

The **Construction Association of Korea** (CAK) is a government-sponsored, but independent organisation. It is mainly concerned with the economic analysis of the construction industry in areas of contract size, construction equipment, patterns of demand for building materials, and building industry employment figures. This information is supplied by all registered contractors and subcontractors and, from its analysis, the *Annual Construction Industry Statistics* is published. Furthermore, the CAK requires building contractors to submit a copy of the building warrant and site plan if the project client and contractor are identical persons or organisations (which is usually the case in Korea). These documents are kept for five years. No computerisation has yet been introduced.

Established in 1978 as a voluntary and non-profit making organisation, the **Korea Housing Association** (KHA) may be said to be equivalent to the UK's NHBC. It is the only sizable organisation concerned with housing research and information in the private sector. It aims to contribute to the improvement in the quality of domestic building construction by providing technical and financial advice. Current membership comprises 52 large building contractors (as of 1987) whose annual contracts in total amount to about 20% of the total multi-family housing production in the private sector (which is approximately 8% of the total national housing production).[2] One of its major functions is to protect the interests of member contractors by representing their collective opinions to the government.

KHA's member contractors are possible data sources for the HIS. Although the practice is now abolished, the KHA originally (for its first four years) filed a copy of every building application submitted by member contractors for administrative purposes. Another notable function of the KHA is a housing information service which includes the above-mentioned advice. Membership is open to anyone interested in such a service. Access to the current service takes the form of telephone enquiries, personal visits, and a subscription to the monthly *Housing* Information published by the Housing Information Centre of the KHA. Computerisation of this service has not yet been introduced.

The **Korea Institute of Construction Technology** (KICT) is roughly equivalent to the NCLI in the public sector in terms of roles and responsibilities.

2 The figures are based on their housing production during 1985-86 and are referenced from 1986 Report of KHA.

However, KICT is a more suitable candidate for the HIS than NCLI because of its extensive sponsorship from the Construction Industry Association and large building contractors throughout the country. It also provides building and construction information to anyone interested.

1.3. PRIVATE COMPANIES

There do exist a number of commercial computerised housing information services, yet none deals specifically with design oriented information. Instead, their concerns are mostly with information on real estate transactions, handling only small quantities of information.

Publishing houses may prove worthy of further consideration. Current prominent magazines relating to building and construction are 'Space', 'Decoration', 'Total Design', 'Environment and Landscape', 'Architecture and Environment', 'KIRA Journal', 'Architecture and Culture', 'Housing Information', 'Modern Housing', 'Apartment Life', 'Architecture and Materials', 'Energy Conservation', etc. Each is concerned with general architecture, interior design, landscape and environments, with some having a bias towards theory, and others towards practice. Magazines concerned solely with housing tend to deal less with the physical or aesthetic aspects and more with the economic, political and social aspects of housing.

In general, most publishing houses lack both in corporate size and available information resources to emerge as viable candidates. Possible exceptions are the 'KIRA Journal' (published by the KIRA) and 'Housing Information' (published by the Housing Information Centre); these publishers have established channels of communication with both the potential information providers and users. However, in view of the commercial insecurity involved, particularly in the initial stages of implementation, there can be little or no incentive for them to commit themselves to the service without any substantial support from outside.

The organisations described so far are all located in Seoul or the immediate vicinity.

2. JOINT VENTURE IMPLEMENTATION AND THE PRACTICAL INTEGRATION OF THE H.I.S. WITH PLANNING INFORMATION SYSTEMS

The organisations introduced in the preceding section also represent potential beneficiaries of the proposed HIS. However, it is unlikely that this kind of information service would be implemented as a result of the independent initiative of any one organisation. In fact, because the value of pure information tends to go unrecognised, the potential benefits of an information system may be measured unfavourably against the considerable initial investment needed to start it up.

In practice, the implementation would be better carried out by way of a joint venture, involving many of the above-mentioned organisations in sharing the financial and organisational burden. This would ensure the following advantages for the participating organisations:

(1) Elimination or minimisation of resources wasted through unnecessary duplication in the collection, storage and analysis of housing data.

(2) Provision of housing statistics on a more regular basis, and in greater detail.

(3) Greater progress in the co-ordination of data standardisation.

Almost all the organisations interviewed showed no enthusiasm for committing themselves to the HIS, as they considered their current work load already quite sufficient. Nevertheless, they were in general sympathetic to the concepts underlying the HIS and agreed that their own tasks could be simplified greatly by the HIS. The hurdle then becomes that of providing sufficient initial incentive. They suggested that the incentive should be initiated by central government, it being in a position, not only to provide the necessary funding, but also to seek necessary co-operation from all sectors of construction industry. It was also recommended that the service be implemented in a way so as not to overburden any existing organisation, but instead to set up a new independent agency.

The implementation of the HIS for any one professional group or particular organisation would be considered something of a luxury at present. Instead, the costs and benefits should be spread out within the community of all potential users concerned with housing development and research. Therefore, it is recommended that the initial investment be supplied by the government and/or shared by all interested organisations in the construction industry.

The integration of the HIS with planning information systems to form a national housing data bank would be a viable proposition. As mentioned briefly earlier in Section 1, a planning-oriented housing data bank was proposed in 1983. It appeared in 'The Study on the Improvement and Effective Utilization of Housing Data System', forming a part of the 'Final Report on Housing Policy Development Research' which was carried out by the KRIHS under a contract with the KNHC. The study pinpointed many of the institutional drawbacks associated with the collection and utilisation of housing statistics. Firstly, the collection of housing statistics is only intermittently carried out, and the statistics cover only a limited geographical area. Secondly, there are inconsistencies of usage and definition of data, sometimes even within one statistical survey. Thirdly, since the time gap between data collection and its eventual appearance in statistical form can be very great, often one or two years, the potential benefits are greatly reduced. Fourthly, obtaining relevant statistics often proves to be very difficult, as much of it is scattered and unavailable to the general public. Lastly, many of the qualitative aspects of housing are difficult to assess and are not presented in any meaningful or detailed manner.

One of the recommendations put forward in response to these problems was the conception of a centralised housing data bank (clearing centre) linked to secondary data banks. Although no definite or detailed structure, or the means to realise it, was specified, the urgent need for such a data bank has been voiced on many occasions, and from a number of different angles.

Presently there are about twenty official statistical surveys being conducted, which are concerned either partially or exclusively with housing. A housing information service of the nature proposed here cannot expect to completely satisfy all the information requirements of planners involved in housing. But it may well cover many of the aspects of housing in sufficient depth, considering that the degree of detailed description of housing schemes required by architects far exceeds that required by planners. Of the twenty surveys, at least four could be replaced by the HIS (with the currently proposed levels of detail), providing that the HIS is implemented on a national scale and with the help of local authorities. These four surveys are:

(1) *Building Permits Statistics* currently prepared by the Department of Architecture of the Bureau of Housing in the Ministry of Construction.

(2) *Building Starts Statistics* currently prepared by the Department of Architecture of the Bureau of Housing in the Ministry of Construction.

(3) *Apartment Living Condition Statistics* currently prepared by the Department of Housing Policy of the Bureau of Housing in the Ministry of Construction.

(4) *Apartment Residents Statistics* currently prepared by the KNHC.

Besides the four listed above, there are many other statistical surveys which stand to benefit, to varying degrees, from the implementation of the HIS.

3. IMPLEMENTATION STRATEGIES

As stated in Chapter 9 ('Cost Analysis'), the first stage of implementation must be regarded as an investment to be financed by interested organisations and/or the government since it is unlikely that any service could be offered that would justify imposing fully economic charges at the outset.

The choice between establishing a national service from the outset or building it up in phases has been described in Chapter 6. The latter would undoubtedly have the advantage of reducing the initial capital investment needed, whilst also securing time in which to receive and reflect upon useful opinions from information users about the performance of the service. One recommendation is for the first stage of implementation to be carried out within a particular region of Korea, that of Seoul and Kyungki region which has the highest concentration (over 50%) of all potential user firms and individual users. This first stage may also involve only a limited number of schemes and/or the most essential subset of the data items (i.e. Level 1 data).

If, after the first stage of implementation, it were decided to expand the service, it should be along the lines suggested in the preliminary considerations of implementation discussed in Chapter 6, which are:

(1) Expand the number of schemes within Seoul and Kyungki.

(2) Increase the level of detail of information on each housing scheme.

(3) Increase the geographical coverage.

As the service gained acceptance, more schemes within Seoul and Kyungki region would be provided. More detailed levels of information may have to be provided, reflecting the needs of various user groups using the service. Additional data items may have to be supplemented in order to cater for the needs of user groups, not originally envisaged, who have however seen the service as a valuable tool for their practice.

The service could, in due course, be extended by the inclusion of schemes in areas beyond Seoul and Kyungki. Upon appraisal of the initial implementation, more regional information centres may be established to provide local users with greater accessibility. In view of the administrative and geographical zoning of Korea, these may be increased to up to nine regional centres within a reasonable period of time. These centres may take the form of branches of the public or professional organisations previously described, and may be connected to the central body of the HIS via telecommunication networks. They should be organised so as to provide valuable links in the communication chain leading outwards from the central organisation, which then acts as a clearing centre, forming a national data network for housing information.

It is important not to be over-ambitious at the beginning. What is most important is to get the service off the ground, to see what the real demands are, and to extract useful user responses. This will provide a sound basis for any long-term strategy for the service. Further expansion will undoubtedly concentrate on existing methods of communication to user groups, keeping in line with developments in information technology, for example, electronic mail, compact discs or viewdata services (such as the British Telecom's Prestel service). The organisation of a publication service should be considered if, after monitoring user response, clear preference was shown for information in paper form. The publication service may include the production of summaries, reviews and examples of the best of current housing practice.

PART THREE

THE PILOT STUDY AND USER ACCEPTANCE

CHAPTER ELEVEN

A PILOT STUDY FOR THE INVESTIGATION OF USER ACCEPTANCE

The eventual overall scale and form of the proposed Housing Information Service cannot be determined until a full scale enquiry into its viability is carried out. This enquiry should be directed at three broad areas, namely:

(1) A study of its acceptance by practising architects and related professionals, and the effect of the service on their current information activities.

(2) An estimate of the number of firms and individual practitioners willing to use the service at various cost levels.

(3) The degree of financial and institutional support from various organisations, including governmental agencies who may have an interest in the service.

Each of the above areas calls for large scale research and investigation with working designers for a considerable time period, the research being centred around a practical demonstration of the system as it might be in use. In effect, this is similar to a form of market survey, and as such should determine a reasonable estimate for the initial size and scale of the service, and whether the service would ultimately be used sufficiently to make it economically viable. Whilst acknowledging the difficulties of launching large scale enquiries at this stage, these issues have been explored to a limited extent, with particular emphasis upon (1) above. Additionally, the principal assumptions on which the concept of the HIS has been based have been reappraised and the proposed forms and methods of information handling re-examined.

For the investigation, a pilot system has been developed containing only a limited amount of essential data critical to the analysis and appraisal of housing schemes. The system has been designed to be universally relevant rather than confining its use to a particular context.

This chapter is concerned with a pilot study set up to investigate user acceptance in the UK and Korea, analysis of which is followed up in the following chapter. Details of the pilot system, the sample of housing schemes contained therein, and the participants involved in the demonstration are described below.

1. METHODS OF ENQUIRY AND PILOT STUDY PARTICIPANTS

Initially, questionnaires were to be sent out in order to obtain first impressions from various groups of practitioners. However, this was later considered to be ineffective due to the inherent difficulties in fully describing the concepts and utilities of the proposed service in questionnaire form where brevity is considered critical to obtaining a satisfactory level of response. Instead, practitioners were asked to attend a practical demonstration wherever possible; otherwise, personal visits were made to them.

User acceptance in Korea was measured solely by means of personal interviews, which involved explaining the background of the proposal and showing the information output of the system. Thus, for the summer of 1985 in Seoul, the printed information output of a demonstration system[1] developed by the author at Edinburgh University was shown to the majority of key potential implementing organisations (see Chapter 10) and to a number of individual practitioners. In total, approximately 30 practitioners and organisations including universities and research and development institutions were approached. Although, undoubtedly, the most effective way of obtaining comments and opinions about the system would be to persuade the practitioners concerned to try out the pilot system, borrowing or leasing the necessary computer systems for private research with no external financial support proved to be practically impossible, the general distribution of computers being not so wide as it is in more developed countries.

For the surveys conducted between January and March 1987 in Edinburgh, a series of interactive demonstrations based on a reasonable and intelligible range of system

1 A number of trial demonstrations of a pilot system had been given to eight colleagues of the author's, mostly Ph.D. students in the department, before the actual demonstration system has been completed. These were aimed to supplement the system and to identify general views, both positive and negative, regarding the acceptance of the HIS proposal. Their views helped the author to organise the direction of enquiries in the later investigations.

applications was carried out in the presence of a limited audience drawn from architecture and other housing related professions. In total, eleven subjects attended five demonstrations at the Department of Architecture, University of Edinburgh, the eleven being drawn from the SDD (Scottish Development Department), SSHA (Scottish Special Housing Association), SLASH (Scottish Local Authorities Special Housing: now defunct), NBA (National Building Agency: now defunct), Border Health Board and from the University of Edinburgh itself. All subjects were highly experienced in the fields of housing design/planning, research, administration and management. The sample comprised nine architects and two quantity surveyors, each having, on average, twenty to thirty years' practical experience. They were given in advance introductory notes and an annotated hand-out on the demonstration search, so that they had enough time to study the nature of the demonstration. Each demonstration lasted about two hours, consisting of forty minutes for the demonstration, followed by a discussion period. Participants were also encouraged to operate the system (i.e. menu-driven system: see Section 2.2.1) by themselves.

In both countries, comments were solicited on identical issues. For the survey conducted in Korea, however, greater emphasis was placed on the feasibility of the service in the Korean context.

2. DESCRIPTION OF THE PILOT SYSTEM

This section describes the pilot system in detail, comprising the following subsections:

(1) Data characteristics - data selection and sample housing schemes involved in the demonstrations.

(2) System characteristics - software particulars and detailed information searches carried out.

2.1. DEMONSTRATION DATA CHARACTERISTICS

It was considered that there would be little value in actually going through all the programming procedures of structuring and entering some 1,300 data items for each housing scheme in an effort to develop a final, complete database. After all, as discussed elsewhere, a real system will only evolve after carefully considering all the various financial and technical constraints on the operating environment and, most importantly, after receiving both general and specific opinions and recommendations from the housing and construction industry. Instead, the aim here was simply to provide evidence of the substance behind the hypothesis underlying the study, and to suggest directions for the eventual form of the HIS. In this respect, a small but workable program[2] was written, involving first, third and fifth level data items, and part of the second level (representing two aspects of housing in detail), amounting to approximately 150 data items.

After data items were chosen, housing samples were collected. From the summer of 1984 to the spring of 1985, information on over 300 housing schemes was collated on a somewhat random basis, before selecting the final sample. The information was derived from speculative housing developers, architects and other housing related organisations and public offices, most of them potentially suitable candidates for the HIS implementation. The data collected was mostly in the form of copy documents and drawings[3] officially required for building warrants, institutional examination or for filing purposes in professional and voluntary organisations. These 300 schemes were then sorted according to three criteria: (1) whether the scheme was a good example of its kind; (2) the availability of substantial detail from the source material; and (3) schemes built in the City of Seoul or Kyungki region.

As a result, 43 domestic housing schemes were initially selected for the pilot system: these consisted of 36 apartment schemes and 7 terraced housing schemes. Later on, the sample was extended to include 10 foreign schemes (6 apartment schemes and 4 terraced housing schemes) which were selected from housing monographs and magazines with a view to eliciting, as far as possible, comments and opinions on the possible international application of the service. This made a total of 53 schemes, comprising 42 apartment schemes and 11 terraced housing schemes.

---

2 It is generally assumed that the nature of enquiries will differ, more or less, with the enquirer's profession, e.g. clients, architects, planners, etc. The eventual overall range of enquiries can only be identified after actual implementation of the service. With this in mind, the demonstration system was built upon a reasonable anticipation of the typical kinds of enquiries the targeted user groups would be making.

3 Where accurate measurements were not specified in the documents or drawings, data was taken off by means of desk appraisal and measurement. Thus there may be some small discrepancies between actual dimensions and those scaled off by the author.

2.2. DEMONSTRATION SYSTEM CHARACTERISTICS

The pilot system was based on the SIR/DBMS, a software package available within the university, and run on a VAX/VMS. SIR (Scientific Information Retrieval) is an integrated database management system and offers the user-friendliness and convenience of a relational database. It uses the SQL query language. Being based upon hierarchical and relational file structures, it processes multiple record types and allows for a direct interface to SPSS (Statistical Package for the Social Sciences) and SAS (Statistical Analysis System). It is particularly suitable for large and/or complex data structures and is widely used in universities and public sectors around the world. In addition, it is easily portable to other computer systems [1].

Displays of building plans were also incorporated into the demonstration. The software used was BADGER, a graphics system developed by EdCAAD (Edinburgh Computer-Aided Architectural Design). The operating system was UNIX (Version 7) run on a DEC PDP 11/73. Because of the connection difficulties between two separate systems (i.e. database and graphics systems), two terminals were used.

It is clear that the more schemes contained by the system, the better are the chances of a closer match with the enquirer's requirements. When the service is in full operation, a far closer match with schemes of interest will be achieved, but, with only 53 housing schemes for the demonstration system, the range will be much narrower. Thus, for the most part, planned searches were carried out, based on two different approaches, one menu-driven,[4] and the other, a conventional database approach.[5]

---

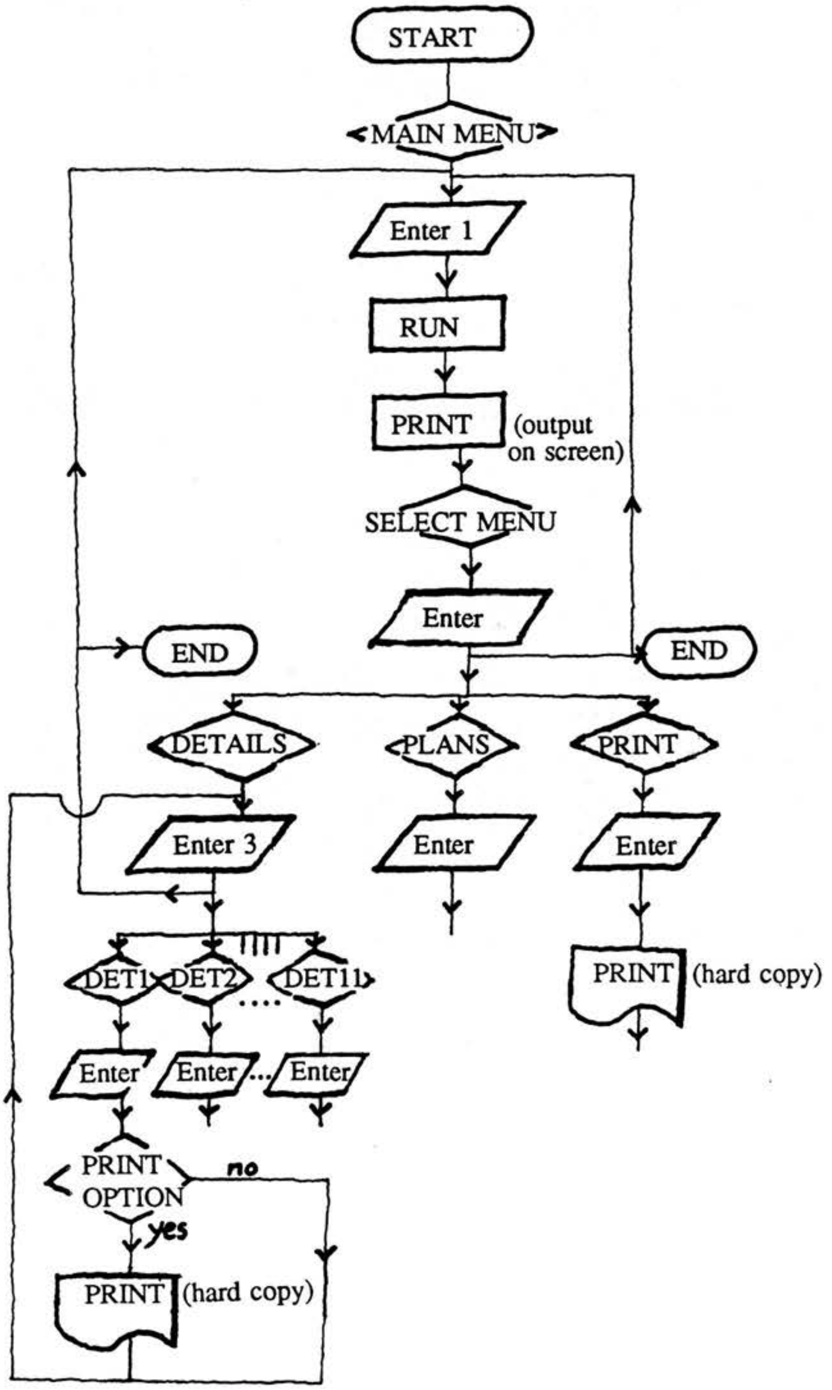
4 A menu-driven approach refers to a technique used in user-friendly systems, functioning as an alternative to the direct keying of commands into a system. In this approach, a list of available options is displayed on the screen, (the VDU,) from which the user selects an option by keying a number representing the option. The advantage of this is that a user does not need to learn commands or consult reference manuals to operate the system.

5 A database approach refers to an approach in which a user keys commands directly into the system. Users are required to learn commands to produce the desired information output.

2.2.1. A MENU-DRIVEN SYSTEM

A degree of user-friendliness has been incorporated into the system by guiding the user through a hierarchy of menus. The detailed hierarchy and option selection of the system are summarised in Fig. 1.

FIG. 1. Flow Diagram



The complete subroutines corresponding to the above flow diagram are contained in Appendix E.

As soon as the system is activated (START in Fig. 1), the user instruction (Fig. 2) appears, which is then followed by the entering of individual values by the operator (Fig. 3).

FIG. 2. User Instruction in MAIN MENU ("MAIN MENU" in Fig. 1)

```
Welcome to the Housing Information Service !

** SCHEME SELECTION **

You will be prompted for the characteristics of the
schemes you wish to investigate. The following values
will be requested : Upper and Lower limits on NUMBER
of DWELLINGS, SITE AREA, CONSTRUCTION COSTS,
LOCATION and the FORM of HOUSING.

( HOWEVER, you may SKIP characteristics of no interest
  to you. )

A search for relevant schemes will be made using these
limits. Further information subsequently be requested.
( The system uses sq.m. for SITE AREA. 1 acre is
  approximately 0.4 hectares or 4,000 sq.m. )

For the NUMBER of DWELLINGS, SITE AREA and
CONSTRUCTION COSTS, you are required to enter
a range of values that includes your particular requirements.
Supposing, you require approx. 400 dwellings, you could
enter 380 for lower limit and 420 for upper limit.

The housing form you have chosen will be the predominant
form, thus it may or may not involve other forms of
housing.

Press RETURN to continue :
```

The top level menu was derived from the anticipated dominant enquiries, beginning with one or more of the following conditions (Figs. 2 and 3):

(1) Geographical location

(2) Construction costs

(3) Form of housing

(4) Area of site

(5) Number of dwelling units

The search process may be initiated by using any one or any combination of these five top level variables.

FIG. 3. Main Menu Selection ("ENTER 1" in Fig. 1)

```
*** REMARK ***   START RETRIEVAL TRANSLATION.
*** REMARK ***   START RETRIEVAL EXECUTION.
Enter lower limit for Dwellings:
Enter upper limit for Dwellings:
Enter lower limit for Site Area in sq.m.:
Enter upper limit for Site Area in sq.m.:
Enter lower limit for Construction Costs in thousands pounds:
Enter upper limit for Construction Costs in thousands pounds:
Enter Country Code: 26
Enter Region Code:
Enter Code for Housing Form: 4
```

As an additional facility, 'help' instructions are incorporated into the system (Fig. 4), to help with the appropriate coding of data items, and generally, with explanation and advice.

FIG. 4. Help Instructions in MAIN MENU ("MAIN MENU" in Fig. 1)

** HELP Screen **

Codes for COUNTRIES are :

1. Australia	-	-	11. ISRAEL
13. JAPAN	14. KOREA	23. SPAIN	24. SWEDEN
25. SWISS	26. UK	27. USA	-

Codes for REGIONS are :

1. KANGNAM	2. KANGDONG	4. KWANAK	11. SUNGDONG
13. YEONG'PO	14. YONGSAN	16. CHONGRO	18. S.INCHON
19. E.INCHON	20. N.INCHON	23. KWANG'NG	25. TONGDU'
26. PUCHON	28. SONGTAN	29. SUWON	30. ANSAN
31. ANYANG	32. EUIJ'PU	40. SIHEUNG	47. YONGIN

Codes for Housing Form are:

1. Detached houses	2. Semi-detached	3. Terraced
4. Flats	5. Maisonettes	

N.B. Codes for countries and regions are abbreviated.

As soon as the relevant schemes and their details are identified, the user has *five* options to choose from (Fig. 5). He or she may:

(1) Display a detailed analysis of the schemes identified.

(2) Display plans of schemes of interest.

(3) Print out the results of the search and any related detail at any instance of the search (this may be in text or graphical form).

(4) Go back to the Top Level Menu and start a new search (in case the last search was unsatisfactory, or in order to narrow down the range of schemes identified in the previous search).

(5) End the session.

FIG. 5. Selection of Menu ("SELECT MENU" in Fig. 1)

```
SIR/DBMS EDITOR READY

    ** YOUR Current Selection Criteria are :
    Dwellings between < > and < >
    Site Areas between < > and < >
    Construction Costs between < > and < >
    Region < > , Country <26> , Form <4>

    ** The Schemes of Your Interest are :

684001  Bonamy Street Scheme
700002  North Peckham
730001  Fullers Slade
754001  Camden Estate

 **  **  **  **  **  **  **  **  **  **  **  **

 ** SELECTION MODE **

 1. Details

 2. Plans

 3. Print

 4. Begin New Search

 5. End the Session

Enter Option : 1
```

For a memory aid, the scope of the enquiry is made to appear in the upper-most part of the screen (see Fig. 5 or 7) during consecutive searches.

Each selection mode in Fig. 5 follows a path of subroutines. For example, if the user decides to see detailed descriptions of the housing schemes retrieved, a subordinate menu selection relating to the detailed description will follow (Fig. 6).

FIG. 6. Selection of Detailed Description ("DETAILS" in Fig. 1)

```
** DETAIL SELECTION **

1. Location, construction period, architect, competition
   & design awards history & various nature of scheme.
2. Physical description of Site.
3. Block particulars , including garaging and parking
   provisions.
4. Dwelling Unit particulars.
5. Construction Particulars , including structural and
   H V A C types & external materials and finishes.
6. Concise Construction Costs particulars.
7. Published Coverage on scheme.
8. Feedback from Project Architect or Editor.
9. Density Figures of Scheme.

10. External Space Provision detail.
11. Internal Materials & Finishes detail.
_____________________________________________________
Or
 IF You wish to go back to Selection Mode, type 's'.
 IF You wish to start a New Search, type 'n'.
 IF You wish to end the session, type 'e'.

Enter option : 1
```

The user is given a choice of 11 groups of detailed information. He may also go back to a previous step, start a completely new search, or end the session. Suppose he selects one of the groups of information shown in Fig. 6, the system will then ask him to specify the scheme he is interested in (see Fig. 7).

FIG. 7. Scheme Identification ("ENTER 3" in Fig. 1)

```
   ** YOUR Current Selection Criteria are :
   Dwellings between < > and < >
   Site Areas between < > and < >
   Construction Costs between < > and < >
   Region < > , Country <26> , Form <4>

  ** The Schemes of Your Interest are :

684001  Bonamy Street Scheme
700002  North Peckham
730001  Fullers Slade
754001  Camden Estate

Enter Identification Number of Your Interest  : 730001

  ** Retrieval is being performed. **
```

Upon the entry of a scheme identification number, the system retrieves the detailed description of the information group previously selected by the user (Fig. 8).

FIG. 8. Detailed Description of An Information Group ("DET1" in Fig. 1)

```
Fullers Slade  at Milton Keynes NT
Architect : D. Walker


 Construction started   in MAR 30, 1971  and
 Construction completed in JUL 19, 1973

 Is this scheme a Mixed Use Development ? : Yes
 Is this scheme a Public Housing ? : Yes
 Is this scheme a Private Housing ? :
 Is this scheme for Owner occupied  :
 Is this scheme for Rent ? : Yes
 Is this scheme for both Sale & Rent ? :
 Is this a Housing Association scheme ? :
 Is this an Elderly Housing scheme ? :
 Is this Single-person Housing ? :
 Is this a Resort or Second Home scheme ? :
 Is this a Mobile Home Park scheme ? :
 Is this Educational or Institutional Accommodation ? :
 Is this a New Town Development ? : Yes
 Is this scheme a Planned Unit Development ? : Yes
 Is this a Rehabilitation scheme ? :

 Competition organised by, if any : *
 Competition in *

 Design award from, if any : *
 Design award in *

*** REMARK ***   RETRIEVAL COMPLETE.
```

The user may print out the information shown on the screen (Fig. 9). The system then returns to DETAIL SELECTION (Fig. 6), so that the user can begin a new search.

FIG. 9. Hard Copy Print Option ("PRINT OPTION" in Fig. 1)

```
        ** PRINT OPTION **


    If you wish to have a print-out
    of the result of the enquiry,
    type '0'. Otherwise, type '1'.



  Enter Option  : 1
```

The user can see plans of schemes of interest and may also return to other selection modes (Fig. 10).

FIG. 10. Selection of Plans ("PLANS" in Fig. 1)

```
684001 Bonamy Street Scheme
700002 North Peckham
730001 Fullers Slade
754001 Camden Estate

  ** PLAN SELECTION **

  1. Site Context
  2. Site Plan
  3. Block Plans
  4. General Layouts
  5. General Elevations
  6. Structural Drawings
  7. Service Drawings
  8. Other Specialist Drawings
  9. Schedules
 10. Component Drawings
 11. Structural Calculations
 12. Specifications
 13. Bills of Quantities
 ------------------------
 Or
 IF You wish to go back to Selection Mode, type 's'.
 IF You wish to start a New Search, type 'n'.
 IF You wish to End the Session, type 'e'.

Enter Option : e_
```

Examples of information output are also contained in Appendix E, together with corresponding subroutines.

2.2.2. DATABASE SYSTEM

Along with the menu-driven planned searches, the more usual database retrievals were carried out, including impromptu searches on arbitrary topics requested by the audience. Statistical and graphical analyses were incorporated, ranging from the simple analysis to the complex comparative analysis of schemes of interest.

In the following section, a word or number inside brackets represents an example value unique to each variable housing characteristic.

Examples of simple searches demonstrated were:

(1) Retrieve [COUNCIL] schemes designed by [ ] and developed by [ ] in [ ] region, for which parking layouts are [GARAGE COURT INCORPORATED WITHIN HOUSING BLOCK].

(2) Retrieve schemes of [3] storey terraced houses mixed with [8] storey maisonettes for which site slope is more than [15] degrees, roofing material being [PROFILED COPPER SHEET] and wall cladding of [SYNTHETIC SHINGLES].

(3) Retrieve names and locations of [SINGLE-PERSON HOUSING] [POINT BLOCK] schemes which have won design awards from [ ] during [1982-84].

(4) Retrieve summaries of periodicals which contain information on [SOCIAL] aspect of [ ] scheme in [ ] region.

(5) Correlate the number of dwellings and parking space of each [FLAT] schemes [REHABILITATED] by [ ] city council during [1980-86].

More complex searches were also carried out:

(6) Retrieve schemes which meet the following requirements:

- More than [10] storeys
- Shape of block plan is [PENTAGONAL]
- Structural type is [STRUCTURAL STEEL]
- Floor type is [JOIST AND DECK]

Then,

- Describe the feedback on technical aspects.
- Retrieve published coverage on user satisfaction.

Searches involving comparative analysis were included:

(7) Retrieve schemes which meet the following requirements:

- [MIXED HOUSING DEVELOPMENT] located at [ ] or [ ].
- [13] acre < site area < [14] acre
- Shape of site is [REGULAR FORM] of [SQUARE].

- [900] people < population density < [1,000] people.

- Parking space per household > [1.0]

- [£50] per sq.ft. < construction cost < [£55] per sq.ft.

- Heating system is [CENTRAL HEATING] using [OIL].

Then,

- Specify Dwellings per acre, Habitable rooms per acre and Bedspaces per acre.

- Compare their ground areas both absolutely and relatively in graphical form.

- Describe the site context and site planning in detail.

- Compare construction cost details using the National Economic Development Office Price Adjustment Formula.

Part of the information output generated by the database system is contained in Appendix E, together with corresponding subroutines which generated them. It should again be noted that much greater levels of detail both in the search queries and in the resulting output information will be possible with the addition of extra Level 2 information.

The next chapter describes user acceptance of HIS and related issues, as revealed by the demonstrations of the pilot system described in this chapter.

CHAPTER TWELVE

USER ACCEPTANCE OF THE H.I.S.

This chapter describes the results of surveys designed to appraise user acceptance of the HIS. The specific issues dealt with in this enquiry are as follows:

(1) The degree of acceptance of the principal concepts and potential benefits of the service.

(2) The levels of detail in both textual and graphical information required by each group of practitioners, i.e. whether the present level is adequate or not.

(3) The speed of response to information enquiries, i.e. how long users are prepared to wait for information.

(4) The performance specifications of the service.

Despite the great contextual disparity between the UK and Korea, there is a general consensus of opinion about the above issues. The printed information shown to Korean interviewees and the system demonstration in Edinburgh were acknowledged by participants to be sufficient to explain the concepts behind the system.

The demand for the kind of feedback information used for analogical thinking processes - analogical feedback information, with which the proposed HIS is principally concerned - is considered to be closely linked to acceptance of the proposed HIS. Thus, participants were asked initially to define their own needs for external analogical feedback information at the following two stages of design decision making at which the HIS is aimed to be most useful:

(1) The initial stage of design decision making (i.e. briefing), when the need is to understand the design problem and define the scope of problem solutions.

(2) The next stage (i.e. sketch plans), when the need is to reveal uncertainties in anticipated performance of decisions made, or simply to improve the quality of initial design solutions.

Further questions[1] were asked in order to clarify responses to the above questions. These questions, and subsequent responses from interviewees, are described in detail below.

1. ACCEPTANCE OF THE PRINCIPAL CONCEPTS AND POTENTIAL BENEFITS OF THE H.I.S.

It was in principle confirmed by all the interviewees that the more experienced a designer is, the less inclined he or she will be to make use of external analogical feedback information. However, a genuine polarisation of views did become clear on the general need, desirability and effectiveness of feedback information in the design process. Moreover, marked disparities were found with respect to design philosophy and approach. Acceptance or otherwise of the proposed service was found to be linked to these differences.

The quotations used below (unless otherwise noted) represent the collective opinions of the participants interviewed and were recorded during discussions with participants.

1.1. NEGATIVE VIEWS

At one extreme, interviewees unsympathetic to the HIS proposal argued that analogical feedback information would only prove of use on a few exceptional occasions, and that in general, there is no need for such information. It was added that investigation of other designers' solutions tended to occur only during the period of formal training. With reference to the need for such information at both the briefing and sketch design stages, the

1 Wherever appropriate, both positive and negative views identified in the earlier trial demonstrations given to the author's colleagues were fed back to participants in order to elicit more detailed opinions based on their professional experience. Therefore, readers may find many counter-criticisms between the participants appearing throughout the text.

decisive reply was, "If you suggest that a designer studies similar schemes in order to identify the essence of the design problem and later compares his or her solution with them, it may be considered insulting." When asked about the need for analogical feedback when designing unfamiliar housing types, e.g. exceptionally high density or earth-sheltered housing, two lines of scepticism emerged. Firstly, "The HIS may be of use in a small number of unusual circumstances, but then only to a limited degree. But even then it would be something of a luxury." Secondly, "The designer should learn to cope with such unfamiliar situations. Design is nothing if not a challenge."

In response to these replies, they were asked three questions:

(1) Could they be confident that their own design solutions were the best of all potential solutions for a given brief?

(2) Could they predict all the consequences of their primary sketch plans?

(3) Had their schemes always performed according to original predictions?

Responses to the first question broadly followed a general pattern: that is, having studied the design brief (assuming that it has not been compiled by the designer himself), an experienced designer would, in most cases, immediately respond with a (strong) mental conception/picture of the building image. From this image, sketch designs would evolve. The early conception of building image is based on the continuous practical experience acquired from successes and failures in previous problem situations. There will, of course, always exist alternative solutions/images/approaches, each with their own balance of pros and cons. However, as with other design fields, each solution should reflect a designer's individuality. Furthermore, the appraisal of overall building performance can rarely be compared to, say, that of mechanical products, there being only a few aspects of building which can be measured quantitatively. Opponents further emphasised the existence of various intangible and non-measurable qualities intrinsic to each design solution, these being imposed by differing value judgements amongst designers, and the various physiological and emotional feelings of building users. As one interviewee said, "Buildings cannot simply be rated in terms of 'marks out of ten'."

In answer to questions (2) and (3), opponents argued that the ability to predict the future performance of a design depends entirely on experience. When the designer has accumulated experience of designing the same types of building, he should be able to predict most of the post-occupancy performances of his sketch plans. "The divide between your design intentions and actual built performance can only be minimised by acquiring experience in practice. Nothing can help you to narrow the gap." In addition, failures in prediction were not seen to be attributable to the architect but, by and large, to activities at the site after occupancy such as poor maintenance, vandalism, and changes in occupancy.

Individual experience was repeatedly stressed as being the key factor in all design situations. A designer from SSHA stated: "I have never seen the architect who consciously uses existing models for a design project. Feedback is only obtained through one's experience in the working environment of a design practice. It's in your head." Furthermore, opponents maintained that the traditional form of apprenticeship through which a particular skill is passed down through the generations is the only way for a young designer to acquire real design knowledge and experience.

The prevailing view of this category of interviewee was that each and every design is unique. It was argued not that designers neglect to look for feedback information, but that they do not actually need it. "There will never be an identical pair of design problems or solutions. Thus, the solution for one particular set of circumstances will not be the right solution for another." This is, essentially, the main underlying criticism behind the negative view of HIS. None of the opponents had ever employed external analogical feedback information. There was a strong belief that creative designers must avoid any preconceptions about design solutions. "Design should proceed from a free state of mind. Referring to schemes built for similar requirements would only narrow the range of solutions and bring about stereotypes."

When asked about the importance of using feedback information obtained from social surveys on qualitative aspects such as user satisfaction or social activities, the negative response still prevailed. The argument was advanced that user response is arbitrary, ill-considered and superficial and that designers could not infer anything valuable from it. "Say you get 70% likes and 30% dislikes about a thing today. On the next day, you get the complete opposite. How can such volatile user response be reflected in any future design?" It was felt that designers would never produce a practical design if they paid too much attention to such problematic information. Designers should instead use their own deliberation and judgement. In most cases, they can predict with sufficient accuracy and certainty the performance of paper schemes for their eventual users and, correspondingly, how those users would respond to the scheme.

A further contention brought up by opponents was that the frequent lip service paid to Utopian ideals completely avoids what actually happens in practice. It was exemplified by the notion of 'teamwork' in design practice. Teamwork is often put forward as being of vital importance in design, particularly as the scale and complexity of building projects continues to increase. However, the dissection of a project into discrete individual subsections, each with a design team member responsible solely for a designated subsection, is clearly nonsensical, and could lead to chaos. In practice, preliminary schemes evolve in the mind of the project architect, and most later design decisions will continue to be dependent upon him, even where teamwork in the later stages is considered feasible.

Opponents showed a strict adherence to the traditional patterns of work, and embraced it as an absolute principle not to be encroached upon. "Present practice is quite right if you correctly understand the nature of design. That's the only way." In this view, 'design' is regarded almost as an inviolable credo which should not be logically explained. The proposed service is seen, accordingly, as a violation of its sanctity.

Some ancillary questions were asked in order to establish more accurately the opponents' working methods: i.e. how they use coverage of schemes in the popular architectural magazines. They were asked specifically why they review them, and what level of detail they expect from them. The predominant reply suggested that it is only a random activity - to know the latest trends and current state of the art or simply to refresh the imagination. This activity seems unrelated to immediate project development. "It's true that we get some insight for future projects through that process, but for those purposes we often get more from fashion magazines." They also maintained that the designer does not look into the detailed characteristics of building schemes but rather looks at holistic images of them. Therefore, they would prefer a few good quality pictures and illustrations of a scheme to a detailed written analysis.

Furthermore, the need for any building study at the outset of a project development was questioned. It was thought by opponents to be carried out only by students or inexperienced designers with the sole purpose of investigating one or two particular aspects of a building type. It may be true that the building study encourages a genuinely creative approach to design, rather than simply reinforcing conservative stereotypes. However, it is a procedure gone through only in the first few years of design education. Experienced designers seldom do building studies, but rather plough straight in with a preliminary response. This line of argument further implies that experienced designers need not put effort into finding schemes meeting particular design requirements.

It became evident that the opponents felt the proposed service might bring about convergence rather than a divergence of design thinking, resulting in conservative rather than creative solutions. They went on to say that the main concern of creative designers in the initial stages of designing is in the freedom of scope that exists and the level of originality that may be achieved.

The discussion inevitably led to arguments about the custom-made versus the ready-made design. Opponents instinctively felt the proposed service represented an aspect of the 'design environment' they found distasteful, misguided, and unsympathetic to the creative designer: much like the standard plans based on the systems building concept prevalent after the 1960's. They also pointed out that the service might encourage general plagiarism of existing designs.

Their general conclusion was that the service would be neither desirable nor useful. Added to this was the suggestion that it was too heavily steeped in academic assumptions - that any system would fail if it did not take account of the realities of professional practice. "No matter how superbly this kind of information system is developed, it could never be used by a designer." The conceptual hypothesis of the HIS was completely rejected.

Finally, a question was asked concerning the potential value of the service in other areas - particularly for naive clients, brief makers, developers, student training or statistical and research purposes. Except for statistical or research purposes, the reaction from opponents was in general negative. It was argued that naive clients would not be able by themselves to disentangle problems with the sole help of the HIS and would after all have to consult architects, quantity surveyors or developers. They were then asked about the potential of the service for architects or brief maker in advising the naive client on possibilities and consequences of the stipulated requirements and budget. The reply was that it might provoke in the client a stereotyped scheme image which would push him in a particular direction. As a result, the designer would be forced along that route despite its irrelevancy to the current design problem. It was claimed to be undesirable for both sides. Referring to its use for developers and student training, it was said that developers, particularly speculative developers, usually have a stock of standard housing types which they build anywhere, irrespective of site conditions, and that the performance of each is well known. Therefore, the usefulness of the system here was said to be limited. As with the naive client, it was maintained that it would only foster stereotypical tendencies (convergence) in the student or novice designer, lessening the potential for creativity. The service, it was suggested, would be better suited to publishing houses, housing management or academic research societies. In other words, the service was seen to be of help for retrospective search of housing schemes but not for forward creative designing.

1.2. POSITIVE VIEWS

Supporters affirmed that such a service could be practical and beneficial to those preparing housing briefs, and to those designing schemes to meet a given brief. It could be of benefit to those making the initial decision about developing a piece of land. The viability of alternative strategies could be quickly tested and a realistic brief prepared. But for the purpose of comparing one's initial design solution to those contained in the system in the later stage of sketch plans, the system was thought to be of limited value owing to the inevitable time limits at that stage.

Acknowledging the very infrequent use of such information, supporters argued that information is not usually available immediately to hand. The frequently voiced opinion was that if anyone disregards the importance of such feedback and consciously avoids using it even if it is available, then that person is either 'mad or a criminal!' It was emphasised that the designer or developer would want to know, for instance, whether all the constraints had been pushed to the limit, or whether the initial brief represented a reasonable balance of those constraints. It was argued that if an assessment of the schemes representing the typical performance of the housing types and layout in question is known, a wider range of options could be examined than would normally be the case. In other words, a yardstick would be available to compare alternative proposed solutions. Examples were given of sketch plans being approved before analysing predicted cost against the given budget, resulting in many designs having to be substantially altered, or on occasion completely abandoned. In some cases, designers may discover serious errors of judgement in the initial design only when it is too late to go back and start again. Accordingly, desirability of obtaining post-occupancy performance information of schemes similar to the current project was emphasised.

Supporters added that architectural magazines have to some extent become involved with publishing more systematic appraisals of buildings in use but that their activities are still fragmented and largely insufficient.

Regarding the notion that 'every design is unique', supporters generally agreed that there are certainly different contexts and constraints for each project and a solution has to reflect such variables. However, they maintained that the argument of the opposition is, by and large, based on a perfectionist tenet. A former deputy director of the Scottish NBA added that the notion is understandable in a sense, but, in reality, similarity of design problems as well as solutions is unavoidable. He went on to say that the repetition and standardisation in the field of housing has been seen everywhere over the past 40 years and that the future is likely to see a general increase as the mass-production and prefabrication of building components, and standardisation of construction practices continue. He quoted a study of the joint user requirement group of SDD, SLASH and NBA, which scrutinised fifteen low rise local authority housing schemes. "All fifteen schemes had a high degree of similarity, the house type in seven schemes being more or less identical in spite of the fact that a diverse sample was sought." He said this prompted NBA to publish 'Generic House Plans' and 'Metric House Shells'.

Faced with the negative responses from the opposition about the use of the system at the two aforementioned stages, supporters counter-argued that it was attributable to certain architects' overconfidence in their design abilities. They stressed that many architects would regard themselves as having a deep, implicit understanding and insight into given design problems, and would probably consider their solution the best possible. It was added that many designers work within style-related parameters that are likely to be observed between schemes they have undertaken; and do not bother to search for other forms of solution possibilities. They argued that these actually confine many architects to narrow stereotypical boundaries, resulting in a lack of variety and flexibility in design decision-making. The lack of an exploratory attitude was held to be partly responsible for this, and it was said to be a reason for critical set-back in architects' continuing professional development.

Supporters drew attention to the crucial need for ongoing criticism from colleagues at all stages of the design process. "You're borrowing other people's knowledge and experience in order to obtain more information and insights. You might also find potential faults which you would have made without such criticism." They claimed, accordingly, that if one accepts that one's knowledge and experience is limited and that the proposed system substitutes such cumulative knowledge and experience, the concept and usefulness of the proposed system is validated.

The general consensus of supporters was that it is ultimately dependent upon how one assimilates existing solutions, whether they can be used as analytical tools for decision making or not. The argument is simply that design cannot occur in a vacuum, and that building designs are born out of prior conceptions formed either by immediate firsthand experience of similar design problems or by the accumulated observation of buildings undertaken by others. As a participant from the Border Health Board said, "Say, when you walk around the town, the images of impressive buildings are implanted in your mind and they're certainly reflected in your design."

The arguments for and against custom-made versus ready-made design solutions became evident among the supporters. Regarding the potential of adapting existing schemes to a new design problem, it was argued that, even if the service were to be used in the manner of standardised plans, no great harm would be done. It was considered to be dependent upon how it was to be used. Furthermore, another common reply was that the service would, in effect, improve the performance of second-rate practitioners because no one would want to investigate building examples inferior to their own proposed design solutions. "One would learn by imitating and incorporating the better ideas of others. Creativity is, in a sense, acquired through imitating."

The uses of the HIS for experienced designers was discussed in conjunction with building studies. In contrast with the opposition, supporters argued that experienced designers are not completely independent of building studies, although it is true that the reliance upon them becomes less as experience grows in particular types of building. The difference between an experienced and an inexperienced designer's attitude to building studies was thought to lie wholly in the amount of time spent on them. Furthermore, the use of the HIS for experienced designers was also said to be helpful. With increasing experience, a designer develops a set of general design approaches which are applied to identifiable building types, for instance, high density terraced or middle income single-person flats. But where designers have lost touch with a once familiar building type, many of the implicit rules and canons peculiar to that design specialism may have been forgotten.

It becomes necessary then to refer to files and drawings of past schemes previously undertaken by the designer. But much of the information within them rapidly becomes obsolete with time. In this regard, it was contended that the use of the HIS may provide experienced designers with quick, up-to-date information.

With reference to its use in student training, it was held to be helpful for students to better understand the practical reality of design possibilities. Supporters unanimously voiced the view that students have little idea of the realities of design practice when they first enter the profession, as university courses tend to focus heavily on questions of style and originality, whilst not taking proper account of the real world. Lastly, it was added that use of the HIS for naive clients, developers or statistical and research purposes would be valuable, and that great value would be found by brief makers, as it could prevent abortive work by helping them to effectively eliminate unrealistic briefs, particularly for those without experience of the housing type in question.

1.3. VIEWS PARTICULAR TO KOREA

Thus far, the discussion had focused on acceptance of the HIS in a universal context. It is believed that the proposal would be accepted differently in different contexts. During the interviews carried out in Korea, opinions were solicited with particular reference to Korea, and countries in a similar context.

It is obvious that the greater the variety of schemes provided, the more the usefulness of the HIS is ensured. However, in developing countries (although many levels may be distinguishable within this category), there will most likely be a marked lack of variety in local and regional housing schemes. Many interviewees argued that this is linked to a set of constraints which obliges the designer in developing countries to work within limited boundaries. These constraints were identified as:

(1) Low standards in building technology

(2) Lack of building materials

(3) Land shortage and accompanying high land cost (applying only to densely populated countries)

(4) Low consumer buying power

(5) Low levels of public appreciation for good design

Some added that the universal picture of housing practice in developing countries is one of a myriad of housing estates appearing as merely built manifestations of the minimum standards set up to secure basic standards of living. Thus, all appear more or less identical, reminiscent of the serried ranks of military barracks. To the speculative house builder, the saving of a few square feet of land, or the shortening of an inch in wall height may mean an improved return in a situation where consumers have little choice. In the field of public housing, things are rarely any better.

Many argued that the problem of monotonous design has an important negative effect on the perceived value of a system such as HIS, as, even if a variety of schemes were to be provided, it would be of only limited benefit to designers whose boundaries of design freedom are chronically restricted by circumstances. In the end, it comes down to the scarcity of capital and the low level of public design awareness, both of which make successful design significantly more difficult than it might be in the more developed countries. In general, the usefulness of the HIS was seen to be limited in this context.

Many acknowledged that more good quality houses exist in Korea now than in the past, and that the level of design awareness among designers continues to improve. Nevertheless, some supporters who view the HIS as a creative tool argued that the HIS would have better prospects if design awareness were to increase in the profession as well as among the public. The future would also be brighter if there were better quality buildings around them, rather than at present, when most practitioners design buildings not in any way creatively, but rather, with stereotypical attitudes.

Some supporters pointed out the common tendency of designers in developing countries to study the designs of developed countries. (This phenomenon is not restricted to architectural design alone.) It was said to be more discernible among better educated designers who try to seek innovative design solutions - they seem to find no models for innovation from domestic schemes. The reason was attributed to the better design quality of foreign schemes and the general life style promoted by Western standards. They argued that these designers spend some considerable time locating foreign schemes of interest from publications. For this reason, some argued for the HIS to involve foreign as well as domestic schemes, providing that the designer can adapt them successfully to the Korean context.

There is a clear distinction of attitudes and design constraints between public and private practice. In consideration of this, questions were put to practitioners in public and private practice as to how each side viewed the benefits which may be derived from the HIS.

There was considerable consensus on the above issue. The general premises were that the quality of housing in the private sector shows enormous variation whereas that in the public sector is generally more consistent. In the latter, there is greater standardisation in building form and layout due largely to standard plans, cost indices, methods of construction, and so on. This was felt to be the result of two factors: firstly, that the majority of public housing schemes are planned and designed by a single large organisation, i.e. the Korea National Housing Corporation (KNHC); and secondly, that public housing policy is geared towards the mass production of housing for low and middle income groups. It was stressed, however, that the performance and standards of public schemes are by no means necessarily inferior to those of private schemes. Indeed, the public schemes were thought to compare favourably to many private speculative schemes, especially those targeted at low income groups. In short, the quality of public schemes is more or less standardised and for this reason, most interviewees argued that the public schemes contained in the HIS would only be useful within public practice and private schemes within private practice.

Customarily, there is limited design time given to designers. Often, client perceptions of the design process are still primitive. Usually, they demand rapid design output from the designer. The problem is more serious in private practice than in public practice.[2] When asked about the usefulness of the HIS in connection with the design time allowed for a project, there were two contrasting responses. One group of interviewees maintained that, in many cases, a design has to be carried out without recourse to any explicit information activity, but instead, by relying totally on the designer's previous experience and intuitive response. Under these circumstances, the service could be used only when there was sufficient time available. By contrast, the other group argued that the HIS would be more

2 Despite the much greater design time customarily available to public housing designers, one of the designers interviewed at the KNHC said that, for various reasons, a project for 500 dwelling units might have to be designed in a week's time.

beneficial in time-limited projects as it could give an instant reference point from which designers could immediately embark on sketch or scheme design.

Responses regarding the use of the HIS in student training reflected the particular situation of Korean schools of architecture. Although a universal phenomenon, the divide between academic training and working practice is more serious in Korea than elsewhere. This is due partly to the teachers' own lack of practical design experience, and partly to the sterile quality of much architectural design practices (although some architects attributed this to the budget constraints imposed by clients). Some of the practising architects interviewed criticised schools for producing students knowing nothing but a few obscure expressions about design practice. They contended that no practical constraints were taken into consideration in student training. It was understood that design teachers do not sufficiently limit design freedom, with the obvious intention of fostering each student's creative potential. However, most teachers were criticised for having little practical experience and having gone directly into teaching from a research background. They were not aware of day-to-day practical constraints, nor how to cope with them effectively. Young designers interviewed in some private firms confessed that they had undergone serious difficulties when they first stepped into practice. Supporters argued that the HIS could be of help for student training in this regard. There was, of course, equal opposition to the use of the HIS in student training for the same reason described before (i.e. fostering stereotypical tendencies).

2. ADEQUACY OF THE DATA

Inevitably, discussion on the issues of data detail, speed of response and performance specifications of the HIS was mainly held amongst those sympathetic to the service.

As to the level of detail normally required by a designer in the appraisal of a housing scheme, they basically agreed that the Level 1 information would be sufficient for designers using the HIS. Only in exceptional cases would they need further detailed information, and even if it were easily available, there would be no time to scrutinise it in detail. Instead, great emphasis was placed on the need for retrieval of drawings.

There was little argument about the criteria for Level 1 information, according to the particular field one is engaged in. For example, interviewees from the housing management side suggested that important information in the Level 1 category might be: travel distance to refuse disposal, the ratio of children to playspaces, and factors such as energy performance.

As expected, it was found that the criteria for Level 2 information are more subject to personal and contextual variation. Most of the Level 2 information was said to be used when searches based on particularly unusual requirements were carried out, or when highly detailed analyses were required.

On the adequacy of the information at qualitative and subjective levels (i.e. Levels 3 and 4), opinions were divided. One group argued that these levels would not prove critical. They preferred to leave the appraisal of schemes with individual users. It was claimed that even if the feedback appraisal by the building users or the original architect was not provided, scheme drawings would suggest a great deal about the overall building performance. As soon as the drawings and attendant Level 1 or 2 analysis of schemes of interest were found, a designer could quickly evaluate the approximate performance of each scheme.

Conversely, the other group argued that the actual performance of any scheme could seldom be elicited from the drawings and attendant quantitative analysis. They claimed that if the service is to be more than just a library of housing schemes meeting a set of specific requirements, an assessment of the schemes would have to be included. The assessment would involve appraisals of social and residential quality and appraisals of measured performance such as mechanical performance or density optimisation. An analysis of these factors should be made on each scheme. At a more detailed level, similar judgements would have to be made with regard to the planning and specification of the dwellings and external areas. These opinions prompted others to question who is going to appraise schemes, and how objectively it could be done.

From the quantity surveyor's point of view, it was mentioned that far more detailed cost information would be necessary, but as long as the service could quickly point to the proper reference, it would be of some clear value.

3. SPEED OF RESPONSE TO ENQUIRIES

Assuming that the service would be operated as a centralised data bank,[3] there are four basic methods for disseminating information, which may be used independently or in combination: interactively, personal visits to the service, by post correspondence and by telephone. Unless the user is equipped with an interactive terminal and/or printing device for information output, information has to be disseminated, in many cases, by means of postal delivery for which the delivery time will vary locally: for instance, one day in the UK, two days in Korea. If, in the worst case, one has to rely totally on the postal service, both in sending the request and receiving the result, at least two days in the UK or four days in Korea will be taken.

The speed of response and the user's toleration of it were considered by the interviewees to be critical factors in the successful implementation of the service. It was unanimously commented however, that the speed of response to enquiries would eventually depend on who was using the system, what stage of design the user was at and how it was being used. During the initial stages of a housing development when a planner or developer is assessing the potential of a piece of land, speed is not considered to be critical, as the exercise may well range from a few weeks to a few years depending upon the particular conditions of the project. The same time flexibility may also be the case with the client, brief maker or the architect.

For a housing designer, an initial investigation to assist in formulating alternative strategies is followed by an interactive stage when information is required more immediately. Finally, there takes place the slower process of building up information on the basis of the proposed design. In this respect, the use of the HIS was thought to be most beneficial at the initial stages of design. Speed would not be critical at this stage, no matter which kind of communication were to be employed. After this stage, far faster response times were felt to be necessary, as designers would not want to be impeded in the middle of the design process, thereby disturbing the particular chain of thought. The same was felt to be true of the final stages of scheme design when designers most often have to face critical deadlines. "Even if you can find useful feedback or a new idea, it might be

3 A centralised data bank would be the most practicable form for HIS implementation at preset, rather than distributing copies of the database in the form of magnetic tapes or discs.

too late." Thus, unless the interactive use of the system is adopted at that stage, the benefits would be seriously reduced.

4. PERFORMANCE SPECIFICATIONS FOR THE PROPOSED H.I.S.

Suggestions were sought regarding the optimum performance specifications of the final HIS. Apart from the usual requirements demanded of any computerised information service, that is, reliability, accuracy and speed, six broad suggestions, particular to the HIS implementation, were made:

First, the provision of high quality housing schemes. Housing schemes, or certain aspects of them, should be those acknowledged as good examples of their kind, be it in site layout, building design, etc. It was also suggested that particularly bad examples be provided, and that the service indicate the causes of their poor performance and suggest corresponding corrective remedies.

Second, the provision of schemes with unconventional solutions. These should be provided since many users will hope to find in the system a unique solution to a particular aspect of interest.

Third, the ease and speed of interactive on-line searching. The system should be capable of being operated with minimum effort or technical knowledge, and rapid elimination of irrelevant schemes should be ensured so as not to overwhelm the user with large numbers of inappropriate choices.

Fourth, obsolescence of information. The system should be kept regularly up-to-date with new developments in building materials and technology, and new concepts in building form and layouts. In particular, the updating of cost information, taking account of local price variations, should be continuous in order to secure as accurately as possible an estimate of budget for similar new projects.

Fifth, conciseness of information. Performance appraisal, if provided, should be simple and concise. Overly abstract or woolly expressions ought to be avoided.

Sixth, quality of graphics. The quality of graphical representation of a scheme both on the interactive screen and in paper form is important as it directly affects the quality of information assimilated by the user. Thus, the system should make the best use of any technological advances in this area or, failing that, further sources of publication should be indicated showing where better quality representations of schemes of interest may be obtained.

5. SUMMARY OF USER SURVEYS

Every designer has different working methods and different value and belief systems, developed through the long process of education, professional career, and daily life. The pilot study raised questions, not only about the acceptance of the proposed HIS, but also about the inherent ethics and working practices of the architectural profession.

Although individual tastes and preferences were not explored in any great detail, the participants divided into two distinct groups, regarding their attitude to the fundamental concepts underlying the HIS.

Those who were opposed to the HIS claimed that the application of post-rationalised appraisal of building schemes to similar architectural and planning projects could only result in general misfit (on the grounds that no one design solution would fit any other).

Those who were sympathetic to the proposal argued that the analysis of the underlying concepts and associated details of a scheme can either wholly or in part serve as a suitable yardstick for the appraisal of similar projects, and that this would lead to the better performance and productivity of designers.

Throughout the interviews, the proportion of sympathetic participants turned out to be higher than that of antagonists. However, this cannot be taken as indicative of the tendency within the profession as a whole since the sample size is too small for any realistic (statistical) significance. Further samples might produce completely opposing results. Nevertheless, the survey has been able to provide a framework for gauging responses to the proposed service. Moreover, it became clear that no matter how many further practitioners are interviewed, the two general lines of response described would still be the same.

It would be premature to question the economic viability of the proposed service at this stage of the investigation. Nonetheless, the question of cost-in-use has arisen from time to time during the interviews. However, no one has indicated the boundaries of acceptable charges for information use, perhaps because there have been no precedent systems with which to form a reasonable comparison.

CONCLUSION

1. APPLICATIONS OF THE H.I.S.

The HIS proposal is an exploration into how experience and knowledge stemming from past jobs can be effectively used for improving the planning and design of new housing projects. It is merely a step towards a more rational utilisation of resources which have, to date, been largely wasted. Nevertheless, it is obviously a first significant and concrete effort to achieve such a goal.

The HIS, with its sizable and well-organised data base, would provide a kind of ready-made experience and knowledge for designers, yielding detailed feedback information on major aspects of housing relating to planning and design. It will help designers to solve design problems for which there may be a general lack of an internal and cumulative body of experience and knowledge.

Specific instances where the proposed HIS can be used for planners and designers involved in housing projects are many and varied. Furthermore, the areas of use for HIS may be extended to serve related groups of practitioners engaged in the development of housing projects. Some functions of major user categories which are typically facilitated by HIS are: clients or client groups involved in making decisions over projected investment; housing policy makers involved in monitoring current housing schemes and in formulating planning strategies for future developments; quantity surveyors and contractors engaged in costing and tendering; and research workers needing access to detailed and structured sources of housing information.

Aside from its practical uses for housing development, HIS can provide a common basis for structuring and managing design and constructional feedback information on completed schemes - information which is, in conventional practice, inconsistently managed and profoundly wasteful of storage space. It may also be used for retrospective research into past and existing schemes, and for keeping in touch with current developments in the field.

It should, however, be noted that HIS is not intended to relieve the designer of the need for exercising his or her own design judgement, or for fulfilling creative responsibilities. The raw output from HIS will not of itself indicate solutions to a given problem. It can only describe reported instances of past designs; these cannot be expected to represent the whole sum of possible design responses to an immediate problem. Instead, it is designed to be a tool for supporting the designer in making better design decisions by providing analytic support and opportunities to test new concepts and explore potential scenarios. The system should be used to increase the designer's understanding of the given problem by reducing the degrees of uncertainty against which a decision has to be made, and by indicating the likelihood of success attached to some desired outcome.

It is neither presupposed that this kind of information service is essentially central to design activity, nor is it certain that the buildings which are produced thereby will be less expensive, more functional, or necessarily more pleasurable to live in. However, an immediate result of the successful implementation of HIS will be the reduced repetition of mistakes arising from lack of communications from project to project. It will be safe to say that a designer will find himself less preoccupied with uncertainties with regard to design possibilities and their practical implications, and thus more able to devote a greater portion of his effort to thoughtful consideration of other important aspects of design.

Beyond the concerns centred around architectural and building professions, the potential effect and consequence of HIS in regard to the social dimension will be substantial, particularly in countries where very large housing programmes have been established. Korea is a good example. Wide scale housing construction has been carried out since the outset of the First Economic Development Plan in 1962; and for the current Sixth Economic Development Plan period (1987 to 1991), about 300,000 houses are planned to be built every year. By the end of the Sixth Plan period, however, 28.5% of national households will still lack proper housing [1], and this will certainly necessitate continuing extensive housing programmes in the future. It is a frustrating dilemma for housing policy makers that decisions have to be made between smaller numbers of good quality housing and greater numbers of habitation designed only to meet people's basic needs. This dilemma is particularly acute because of the limited resources. In practice, better quality housing has generally been sacrificed to the continual demand for greater numbers.

It would be absurd to argue that HIS will completely resolve this dilemma. However, HIS could at least be used to achieve a more efficient use of the huge capital sums invested on housing, and to enable the realisation of better quality housing by helping those concerned to find a better equilibrium between the two contradictory goals.

2. USER ACCEPTANCE OF THE H.I.S.

It was not surprising that the proposed service would be greeted by some with sympathy, and by others with antipathy and scepticism. As expected at the outset of enquiries, two distinct lines of responses predominated. It is considered that any further enquiries about acceptance would continue to centre around them.

There is a general consensus among supporters for the service that it is a worthwhile proposal. They maintain that whether it is used mechanistically or imaginatively will depend totally on the designer's approach to the system. Real benefits will only be discovered when the system is in use, and the easiest way to promote its use will be to initiate the service with the Level 1 information, before going on to further levels of data as the service gains acceptance.

Opposition to the proposal stems from the following beliefs. First, every design problem or solution is unique. There can be no two identical design problems or solutions. Every design problem has different programming requirements and geographical conditions; its solution is thus affected by the precise formulation of the problem it aims to overcome. Second, the simple complacency of designers. Designers are, to an enormously varying degree, possessed with an overconfidence in their talents for design, and have a blind adherence to the traditions of their profession, resisting any change which might have any impact on them. Third, the notion of architecture as an art form, with particular emphasis on individuality and originality. Designers are filled with a need for personal fulfillment, finding this in the pursuit of artistic solutions rather than solutions satisfying the wishes of ordinary people.

Every design problem or solution is unique. This statement is clearly true, but it is nevertheless overly naive. More realistically, many similarities may be observed between individual design problems - in budget range, site conditions, structural and aesthetic preference of clients, and so on. This is yet further apparent with design solutions. More and more, we see standardisation and modular co-ordination being established for building components, materials, techniques, systems and equipment. Building bylaws contribute partly to this by stipulating minimum standards for planning and construction. Typologies of building form and spatial layout, and the pros and cons of each, are known to every designer, and he or she will have a tendency to apply them to a design problem in a manner similar to the way a scientist uses mathematical formulae. Architects and contractors use certain cost per unit area formulae (rules of thumb) as a means of roughly predicting the achievable quality of construction; within certain limits, these prove to be surprisingly reliable. Accordingly, ever greater similarities in design, in terms of building form and layout, may be observed. Degrees of similarity in problem solution are even more apparent when the original problem requirements are themselves overtly similar.

Each solution to a particular problem is in itself unique, but this by no means entails that it is the only solution to the problem. Architectural design incorporates too many variables for there ever to be the one single design solution. Moreover, value judgements differ greatly from one designer to another. Nor will they remain constant within individual designers. For any particular design problem, one hundred designers will produce one hundred different schemes, each having its own merits and demerits compared to others. It is absurd to say that any designer's final solution is the best possible. We are often simply unaware of other possibilities - alternative approaches to the problem requirements - which may result in 'better' schemes.

Furthermore, the notion that a particular solution fits only a particular problem is a rather fastidious belief. It is doubtful whether the Villa Savoye, the Scott Monument, the Guggenheim Museum or any other great masterpiece would not fit equally well into places other than where they happen to stand today. In fact, the author believes that the Villa Savoye would better suit a more urban setting than it now has, and the Guggenheim Museum a less urban setting. This is a somewhat simplified view. Nonetheless, solutions to particular problems can be, and often are, transported to other problem environments in their original or somewhat modified form, and can prove to work well. This transportation of ideas occurs in every design process - it is in effect what every designer does to produce a scheme.

No designer produces a scheme without making analogical reference to his or her previous experience and observations related to a current project. Feedback from the analysis of existing building schemes is beneficial to future projects as a comparative yardstick, and this benefit becomes greater where problem requirements between schemes are similar.

However, there seems to be a further reason behind the opposition to the proposal for HIS. This is the credo that each design solution *ought* to be unique: "Mine has to be something different from others and should not be an ordinary solution." This preconception is prevalent amongst many designers. Even if the design problem is similar, reuse of a past successful solution is not acceptable, just as no artist would ever reproduce a work of art, in the name of art. Thus past good solutions, even where clearly adaptable to a new problem, *should* never be used again. Yet, observing the working methods of supposedly creative designers often shows an overtly mechanical response to design which cannot be seen as a genuinely creative activity. What they actually produce frequently look alike, being merely minor variations on themes and techniques already well developed in their own previous work.

Today, there is an increasing emphasis on individuality and originality, with these being construed as creativity. Originality is regarded as an end in itself and criticism of originality on utilitarian grounds is said to be a misconception of the true value of designing. This is fundamentally related to the common error of looking at creativity in architecture as being a radical new invention and persisting with a strange adherence to a notion of design as being incapable of logical expression. Many are obsessed with the idea that they should create something noble and innovative and without precedent. These designers often demonstrate a strong disregard for popular criticism of their work. In the quest for originality and individuality, the ancient Vitruvian qualities of, 'Commodity, Firmness, and Delight', are regularly ignored. Whilst the emphasis on such individual values is both desirable and necessary, the lack of rigour in dealing with common social and cultural values is lamentable in design education. In Sweden [2], students of architecture are now obliged to negotiate cities in wheelchairs, push prams around shopping centres, wear special glasses to simulate blindness, etc., in order to appreciate what people actually need and desire. But this is indeed rare. More usually, the general failings in design education leave the designer lacking in skills in those aspects which are of primary importance to the immediate users of their design products. As a result, both the client's wishes and end-user needs are regularly sacrificed in the designer's selfish desire for self-fulfillment.

Few designers would say that the selection and adaptation of precedents are the essence of creativity, but originality and individuality are inseparable from them. Nothing is created from a vacuum. Genuine and fruitful originality derives precisely from the accurate, vigorous and imaginative manner in which precedents are analysed and compared.

Architectural design can be distinguished from other forms of design in several ways. For example, the historian Pevsner [3] has asserted: "what distinguishes architecture from painting and sculpture is its spatial quality. In this, and only in this, no other artist can emulate the architect." Nevertheless, the true essence of architecture is as unclear as Collins implies: "Whether architecture is a profession or an art, or whether it is both a profession and an art, has by no means been settled even today."[4] But what seems clear is that architecture is not an art for art's sake: it involves not only both the aestheticism of fine art and the functionality of applied arts but also an understanding of human behaviour and psychology. Furthermore, the evidence of the history of architecture does not reveal an arbitrary sequence of unique 'creative' building solutions, but rather, a gradual evolution of precedent solutions.

One (irresponsible) claim of many designers is the uselessness of the application of the results of post-occupancy appraisal by firsthand users in the design of future projects. They argue that such results are too volatile and unreliable to be usefully reflected in new designs; and that designers should instead use their imagination and personal judgement as to how schemes will be appreciated by building users. In reality, very few designers have ever bothered themselves to monitor the post-occupancy performance of their schemes on users and to apply it to new projects. In a strict sense, there is truth in the claim that building user surveys are necessarily volatile, but user feedback is still the most valuable source of self-appraisal and criticism available to the designer. Some designers tend to think of their professional service as goods in a shop: "once sold, no future liability involved!" Designers' self-conceit about their knowledge and experience will actually block their professional development and keep them apart from the very people for whom they design. We may recall the controversy raised by the Prince of Wales at a gala to mark the 150th anniversary of the RIBA [5]: "Architects are consistently ignoring the feelings and wishes of the mass of ordinary people and presuming they know best about taste and style." Criticism also comes from within the profession. Rod Hackney, currently the president of the RIBA, was persuaded by a magazine [6] to experience (for one day) the routine life of a mother with her children on a modern housing estate. He admitted after the experience: "... most architects might as well be blind. They have been trained to be part of a special breed, trained not to consult with the public, because that tarnishes their image."

The above causes, central to the opposition, are consequential to many different attributes, but one attribute common to them all is a simple ignorance and indifference on the part of designers, intentionally or unintentionally, to the whole spectrum of the world open to them. Obviously, this is a critical barrier to the proposal presented here.

We still have only a very sketchy idea about some of the critical issues encompassing architectural design - as evidenced by the two opposing views regarding HIS proposal. Any general design theory somehow has to include the two seemingly opposed concepts concerning the design process and the value of information research described earlier in this thesis. At their extreme ends, each opposing view becomes the antithesis of the other. Nonetheless, one cannot be explained without the other. No designer stands full square for one or the other belief system. Instead, they can be seen to fall into positions along a line connecting the two, with individual designers tending to show marked preferences for one system or the other. Generally, designers, who are aware of what each end of the line stands for, and where they themselves stand in relation to it, will have a more open, intelligent and flexible attitude to practical design procedures.

As suggested so far, design may be a concept that can be defined only in terms of thesis and antithesis together. In this respect, the old Chinese relativistic 'Yin-Yang' principle and belief in universal and cyclical recurrence still seem to suggest a great deal to us living in an age when a monochromatic absolutism fails to explain all the phenomena relating to it. In the Chinese cosmic system, all qualities are divided into 'Yang', representing light, heat, dryness and all the generative and masculine essence, and 'Yin', representing dark, cold, wetness and all the receptive and feminine essence. The two halves are the reverse of each other. From their interaction all things come into existence and an ideal harmony can be achieved only when 'Yin' and 'Yang' create balance by complementing each other. The 'Yin-Yang' relationship is never static but always dynamic and essentially of a recurrent nature. As 'Yang' begins to gain, 'Yin' begins to lose, and vice versa. But neither of the two ever perishes.

3. PROSPECTS FOR THE FUTURE

The final scale and form of the Housing Information Service will not be determined until a larger scale enquiry is successfully carried out, which can only take place in conjunction with a number of parallel studies concerning particularly those three areas described earlier in Chapter 11. Nevertheless, if an appropriate incentive is introduced by a suitable organisation such as a large professional institution or by the government, the enquiry could be successfully carried out within a very short time, even a few months.

The economic viability of HIS could have not been conceivable even 10 years ago. The cost implications of computer technology had often been a forbidding constraint, preventing the development of many systems that were otherwise conceptually very attractive. However, the goal of HIS has been made increasingly practicable by rapid changes in information technology. These changes now permit low-cost access to an organised reservoir of feedback information. Although the question of full economic viability of the proposed service might be premature at this stage of the investigation, this study has provided the evidence that the pragmatic issues of the implementing cost of the service no longer pose a significant problem. The estimate of 191 million Won (= £147,000) for implementing HIS can be seen as small when measured against the scale of potential benefits of the service - even though these benefits are not explicitly quantifiable. The cost analysis suggests that HIS is a viable proposition, and should give proper incentive both to interested organisations and to the government. This holds particularly true for any joint venture, where the development costs would be shared out. Furthermore, the continual developments in information technology seem likely to ensure the increasingly improved economic viability of the proposal.

This proposal also advocates the judicious use of information technology, not as an unwanted power over designers, but as an effective tool by which their skill and knowledge may be further exercised.

Technology and society have a mutually interactive influence over each other. We live in the new era of information technology and are unavoidably affected by it. The speed of its development is sometimes awesome and nobody can be sure of what will crop up next. One of the effects of the technological shift has been the gradual change in the nature of operations associated with design thinking and practice. Probably in ten years' time, the whole approach of architects towards information handling and use will be dramatically changed. At present however, architects seem to underestimate the implications and consequences of information technology bearing upon their practice. This is often evidenced by their attitudes and patterns of working, and in their routine conversation with colleagues.

Some of the myths surrounding information technology on the part of designers need to be explored. Designers who are opposed to the use of current information technology, particularly computers, imagine that it will sweep them along in a tide over which they have little control. Computers have been seen as contributory to the collapse of traditional value systems and the loss of spiritual quality that designers have preserved for centuries as the pride and self-esteem of the profession. They resist what they see as the advent of the Orwellian prophecy, in which they play the harassed and exposed victims of a depersonalised and dehumanised process which places greater value on efficiency than on the more noble qualities of value judgements peculiar to designers.

Designers' prejudice and mistrust of the use of computers in the architectural profession can only be overcome through their firsthand experience of computers at the proper instances where they are seen to be useful. The computer and the human mind have different but complementary abilities. If these different abilities can be combined, then we can hope to move towards a more powerful and effective basis for design and design practice.

It is believed that this is now the time when architects should examine more carefully and objectively the potential of current information technology. Simple ignorance will only result in major set-backs to professional development.

The number of data items involved in the proposed HIS is approximately 1,300, at five distinct levels of detail, which have been derived from a broad classification of the six principal aspects of housing. This has been a result of the considerations of all the current informational, technological and operational limitations. As these limitations are overcome in the future, the scope of the data, as proposed in this study, may eventually be extended to include other significant information, reflecting more of the behavioural and social parameters that affect housing design practice.

Finally, the service can in fact take many different forms. There will be a multitude of ways for developing a housing information service, or other building type information services. In this thesis, only one of them is explored. Nevertheless, the study presented here may serve as a yardstick for many problems common to the general type.

Acceptance of the proposal would undoubtedly vary according to the environment in which it will be implemented. It is therefore recommended that the initial service should be established on a small scale, allowing sufficient time to monitor acceptance of the service in operation and to reflect upon issues relating to its further expansion. The implementation should be of a standard to form the basis of a national centre for housing information, taking full account of up-to-date methods for the storage and dissemination of information.

In the near future, HIS may assume a greater role than that outlined here, as developments in information technology progress, and as more practitioners become familiar with its uses. In due course, the system may be linked to design firms and product manufacturers from which digitally stored drawings and up-to-date commodity information are directly transferred, via the service, to the desktop terminals of end-users. With the incorporation of computer simulation packages, HIS may act as an agency for performance appraisal for proposed housing schemes, detailing energy cost-benefit equations, the density of alternative layouts or the relation of budget to income. With a growing acceptance of HIS, information services for other types of building similar in nature to HIS may be reasonably envisaged.

ULI the Urban Land Institute

Project Reference File

1. Prominent entry feature and landscaping distinguish the project.

commercial

Montgomery Knoll

[illegible]

buildings are designed in a neoclassical style and were [illegible] finished with [illegible] standing [illegible] [illegible]

Special Features

- [illegible]
- [illegible]
- [illegible] landscaping
- Proximity to Princeton and accessibility to major cities
- Low-scale siting with abundant parking

Developer

[illegible]
Montgomery Knoll
Montgomery Township, NJ [illegible]
(609) [illegible]

Architect

The Hillier Group
[illegible] Alexander Road
Princeton, NJ 08540
(609) 452-8888

Construction Manager

Russell [illegible]
Montgomery Knoll
Montgomery Township, NJ 08553
(609) [illegible]

October–December 1985

General Description

Montgomery Knoll is a 48-unit office condominium project in Montgomery Township, New Jersey. The units are housed in 13 separate two-story buildings on a 15-acre site and range in size from 1,500 to 1,900 square feet, with a total of 76,800 square feet provided.

Montgomery Township is located near Princeton, New Jersey, in Somerset County approximately one hour's drive either from New York City or from Philadelphia. Montgomery Knoll was the first office condominium project in the area, furnishing space for a variety of office users with limited, fixed needs. Since its development, several other office condominium projects have been planned or developed in the Princeton area.

Montgomery Knoll was planned in three phases; construction of the first phase began in February 1983 and all 48 units were completed by April 1985. Most units were sold before each phase was completed, allowing the interiors to be customized for individual buyers. Purchasers were about evenly divided between investors and owner-occupants.

The project is managed by a condominium association, which held its first election after one-third of the units were sold. The association is controlled by a five-member board of directors, of which the developer remains a member. After all units have been sold, the developer will no longer participate as a member of the board.

The Site

Montgomery Knoll's 15-acre site is located along Route 206, a major north/south traffic artery in the western portion of central New Jersey. The site is approximately four miles north of Princeton in Montgomery Township, a semirural area in which development of major office and commercial space is just beginning. Land uses next to the site are primarily residential although a single-story office warehouse building stands just south, along Route 206. Several other office complexes are located nearby, and Princeton Airport is less than one mile to the south.

The site is roughly rectangular in shape and slopes gently from southeast to northwest, giving the project a natural elevation from the highway. The land was vacant and scattered with scrub cedars before Montgomery Knoll was developed. Woodlands along the site's northern and eastern boundaries form a 100-foot buffer along the perimeter; 25 feet of woodlands buffer the site's southern boundary. The soil consists of Royce silt loam.

Planning

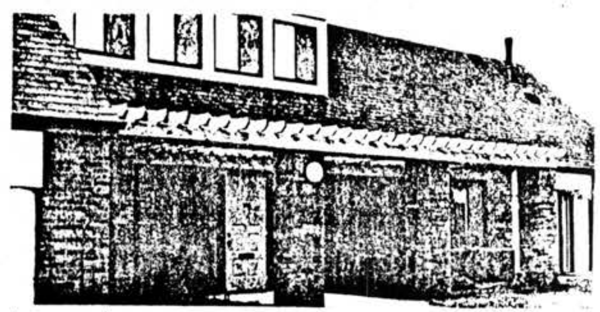
The developer optioned the Montgomery Knoll site and began project planning in September 1981. The site was zoned R-E-O (Research-Engineering-Office); however, a use variance was required to permit the development of 13 separate buildings. Additional approvals were required from the Township Board of Adjustment, the Somerset County Planning Board, the Somerset Union Soil Conservation District, the Delaware and Raritan Canal Commission, and the New Jersey Department of Transportation.

The approval process took approximately 10 months. Construction of the first phase of 19 units began in February 1983 and was completed in August 1983; the second phase of 14 units was completed in April 1984; and the third phase of 15 units was completed in April 1985.

All utilities were brought into the site from Route 206 and installed underground. Because no sewer service is available in Montgomery Township, three gravity-flow septic systems were installed with each system serving four to five buildings. Tanks for the system are located beneath the central open space.

The project's 13 buildings are sited along a private circular road with approximately 10 acres of open space in the center of the site and along its perimeter. The buildings are placed at various angles to the road forming courtyard entrances to the individual units. They are clustered in groups of two or three with each building housing three or four units. Areas surrounding each building and throughout the site have been landscaped extensively.

Parking runs along both sides of the circular road and can be easily reached from each office unit. The developer has provided standardized directional signs at each cluster of buildings, indicating the occupants and their unit members. Several picnic tables are also provided for the occupants' use.



2. Siting and exterior features were varied to individualize units.

3. The trellis units provide architectural variation and have been highly popular with buyers.

Architecture

The architecture of the buildings is neoclassical with brick and precast concrete exterior construction. Two-story transom windows on both the front and back of the buildings dominate each of the 12 units containing 1,900 square feet. The 36 units having 1,500 square feet apiece offer a variety of column and trellis entrances. Nine buildings contain four office units each; the remaining four buildings have three units apiece. All units have standardized, custom-engraved bronze identification signs installed on the building exteriors.

The developer offered four different interior floor plans; however, in many cases, these were customized to respond to the space needs of the individual buyer. The smaller units contain 1,150 square feet on the ground floor and 350 square feet on the second floor for a total of 1,500 square feet. The larger, 1,900-square-foot units have 1,450 square feet on the first floor and 450 square feet on the second floor. Each unit contains a kitchenette and two lavatories, one on each floor. Building systems are self-contained with individual electric hot water heaters and separately metered forced air heating and air conditioning.

Units were delivered with all interior finishes, including wood trims and moldings; floor coverings, including quarry tile in entry foyers; window blinds; and screens. For some items, buyers could choose from a range of colors. A number of residential-type features were included in the units, such as full vanities in lavatories, wood stair rails and operable windows with varnished mahogany sills. Optional features such as showers and quarry tile in lavatories were also offered.

Market

Because office condominiums are a relatively new concept to the central New Jersey area, the marketing program for Montgomery Knoll was carefully targeted. Before construction began a direct mail letter was sent to several hundred businesses in the area. This technique worked very effectively since the units are best suited to businesses with three to 12 employees whose space needs are relatively fixed. The units were advertised in the local newspaper and in area business and trade journals. About one-third of the buyers were introduced to the project by commercial brokers.

Small firms offering marketing, consulting, data processing, and other services are increasingly drawn to the Princeton area by the presence of many larger research and development companies that have been attracted to the area. These firms, as well as traditional professionals—attorneys, accountants, architects—made up the primary market for Montgomery Knoll. The marketing program for the project emphasized the tax and financial advantages of owning rather than renting office space, particularly for small firms.

The units were also marketed as investment opportunities for nonusers. Investors purchased approximately 52 percent of the units and then leased them. Some buyers who purchased more than one unit occupy one and lease one or more to other users. Sales prices ranged from $110 per square foot for interior units to $116 per square foot for some end units.

4. The buildings are separated by landscaped common open space that runs through the center of the site.

Experience Gained

- Introducing a new project concept to a market area requires a great deal of extra time and effort on the part of the developer. Both potential buyers and local officials involved had to be thoroughly educated regarding the office condominium concept.
- Although the buildings are small in scale, the developer found that a number of buyers would have preferred even smaller units or one-level units.
- Many of the unit owners spend an extraordinary amount of time in their offices. For that reason, the residential-type features—kitchens, wooden window sills and stair rails—are very attractive.
- The developer worked closely with the buyers on selecting interior finishes and adapting floor plans to fit the needs of the individual firms. Because buyers make long-term commitments to an office condominium project, it is important that they be completely satisfied with their units.
- The unit design did not include an entrance area or vestibule. Therefore, in most cases, the front door opens directly into a reception area, increasing heat loss and wear and tear on carpeting, especially in bad weather. Some type of entrance vestibule should be included, even with very small units.
- The 10 acres of open space and the front entrance courtyards were seeded. Because of the amount of labor required to tend these areas, it probably would have been easier and more cost-effective to have installed sod. Also, using more mature shrubs and trees rather than young plantings would have given the project a more established appearance.

PROJECT DATA

Land Use Information:
Site Area: 15 acres (6.07 hectares)
Gross Building Area (GBA): 76,800 square feet
Floor/Area Ratio (FAR): 11.7[1]

Parking:
Total Spaces: 385
Parking Index: 5 spaces per 1,000 square feet of GBA
Spaces for Handicapped: 8

Economic Information:

Site Acquisition Cost:	$480,000
Site Improvement Cost:	
Excavation	$ 60,500
Grading	85,000
Water/Storm Sewers	84,000
Septic Systems (3)	66,000
Paving/Curbs	251,000
Sidewalks	48,000
Utility Excavation	25,500
Landscape/Lighting	106,000
Brick Enclosures (trash dumpsters)	17,000
Total	$745,000

Construction Cost per Gross Square Foot: $51.80

Unit Information:

Type	Size (Square Feet)	Number	Sales Price	
A	1,900	12	$185,000	$214,000
B	1,500	11	115,000	170,000
C	1,500	11	115,000	170,000
D	1,500	14	140,000	170,000

Construction Cost:

Superstructure	$2,200,000
HVAC	419,500
Electrical	268,000
Plumbing	159,000
Fees	34,000
Finishes	877,000
Graphics	20,000
Total	$3,977,500

Land Use Plan:

	Acres	Percent
Buildings	1.5	9.8
Streets/Parking	3.1	20.0
Open Space	10.5	70.2
Total	15.1	100.0

Note:
[1]FAR equals GBA divided by total site area

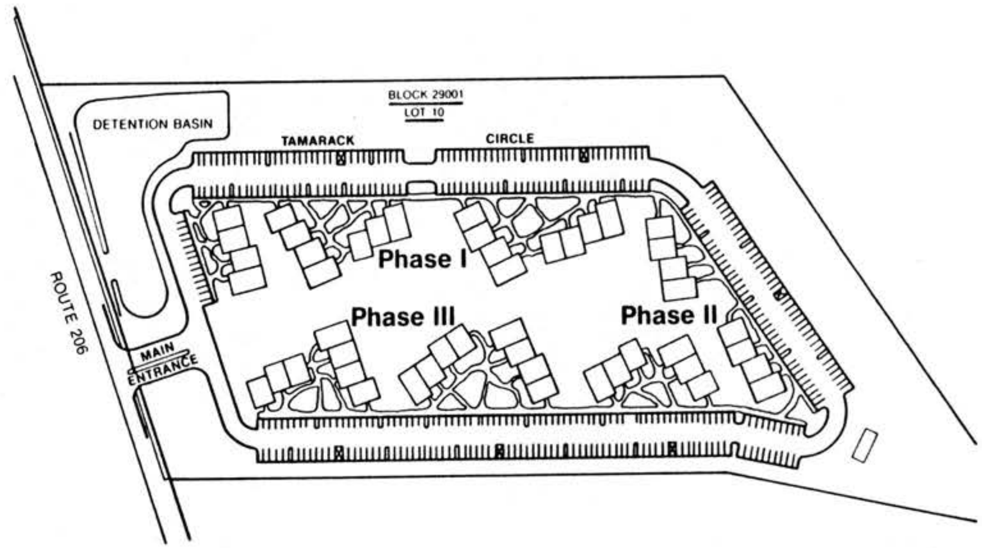
Directions:
From Newark International Airport: Take the New Jersey Turnpike south to Exit 9 to Route 1 south. Follow Route 1 south for seven miles to Sand Hill Road and turn right. Proceed three miles to Route 27, turn left on Route 27 south, and continue to Route 518 west. Proceed five miles to Route 206, turn right, and follow approximately one-quarter mile to project entrance on right.

Driving Time: Approximately 45 minutes in non-rush-hour traffic.

From Downtown Princeton: Take Route 206 north and follow about four miles to project entrance on right.

Driving Time: Approximately five to 10 minutes in non-rush-hour traffic.

Floor Plan—Unit B or C



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APPENDIX B. POTENTIAL ORGANISATIONS ELIGIBLE FOR THE H.I.S. IMPLEMENTATION IN FRANCE, USA, SWEDEN AND W. GERMANY

FRANCE:

(1) **Public Organisations**

MATELT (Ministry of Territorial Development, Construction, Housing, Tourism and Transport)

CNEIL (National Centre for the Design and Promotion of Housing)

CSTB (The Official Scientific and Technical Building Research Centre)

GCVN (Central Group for the New Towns)

(2) **Voluntary and Professional Organisations**

FNB (The National Building Federation)

OTA (Technical Control Offices)

OPQCB (Organisation for Approval and Classification in the Building and Associated Trades) (belonging to FNB and similar in nature to NHBC of U.K.)

FNMOB (National Federation of Building Surveyors)

FNSA (National Federation of Architects' Associations)

CFHU (French Housing and Town Planning Confederation)

CCCH (Confederation of Building and Housing Co-operatives)

SMI (National Union of Constructors of Private Houses)

CIDELT (Construction, Housing and Transport information Centre)

USA:

(1) **Public Organisations**

HUD (U.S. Department of Housing and Urban Development)

(2) **Voluntary and Professional Organisations**

AIA (The American Institute of Architects)

AIP (The American Institute of Planners)

NAHB (National Association of Home Builders)

SWEDEN:

(1) **Public Organisations**

SIB (National Institute for Building Research)

Royal Board of Housing

Svenska Landstingsforbundet (Swedish County Councils Federation)

(2) **Voluntary and Professional Organisations**

SRB (Co-operative Housing Organisation of the Swedish Trade Unions)

HSB (Associated General Contractors and House Builders of Sweden)

SBJ (Swedish Building Information and Documentation Centre)

SAR (The National Federation of Swedish Architects)

AB Bostadsforskning (Housing Research Company)

WEST GERMANY:

(1) **Public Organisations**

Bundesministerium fur Raumordnung, Bauwesen und Stadtebau (Federal Ministry for Regional Planning, Building and Urban Development)

BLG (Federal Association of States Public Authorities)

Deutscher Gemeindetag (Assembly of German Local Authorities)

(2) **Voluntary and Professional Organisations**

BDA (Bund Deutscher Architekten: Federation of German Architects)

BDVI (Federation of Officially Approved Surveyors)

Deutsches Volksheimstattenwerk (German People's Housing Enterprise)

Bundesverband Privater Wohnungsunternehmen eV (Federal Association of Private Housing Developers)

Bundesvereinigung Deutscher Heimstatten eV (Federal Association of German National Housing Corporations)

FBW (Building and Housing Research Association)

VDB (German Building Centre Society)

Institut fur Bauforschung eV (Building Research Institute)

APPENDIX C. BUILDING APPLICATION FORMS USED IN KOREA, JAPAN, U.K., U.S.A. AND WEST GERMANY

KOREA : (APPLICATION FOR CONSENT)

(별지 제26호 서식) 삭제 < 82.3.20 건설령 321>
(별지 제27호 서식) 삭제 < 82.3.20 건설령 321>

(별지 제28호 서식) <개정 83.8.8 건설령 362 >

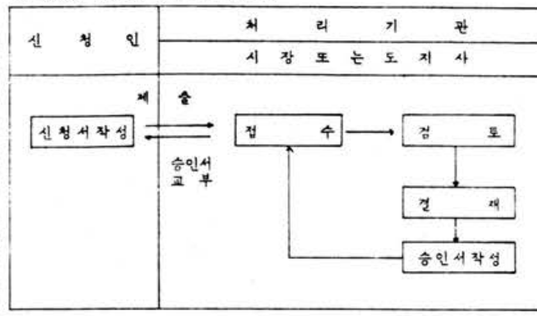
□ (국민/민영) 주택건설 □ 대지조성	사업계획승인신청서			처리기긴 30일
신청인	①상호		⑫지정등록번호	reg. no.
	③대표자	applicant	④영업소소재지	address
설계자	⑤성명	architect	⑥자격	qualification
	⑦주소	address	(전화)	
공사시공자	⑧성명	contractor	⑨자격	qualification
	⑩주소	address	(전화)	
사업계획	⑪사업위치	site location,	지역 zoning	지구
	사업내용	13 대지면적 / site area	14 건축연면적 / tot. floor area / 15 주택형별 / 16 주택수 / no.sep. blocks & dwelling units / housing form	17 사업비 / est. cost
	사업기간	18 착공예정일자	19 준공예정일자	estimated construction period

주택건설촉진법 제33조 및 동법시행령 제32조의 규정에 의하여 위와 같이 사업계획승인을 신청합니다. 19 . . .
신청인 ㊞
(시장·도지사) 귀하

구비서류 : 이면	수수료
	없음

2805-01-45E
80.10.6 승인
190㎜ × 268㎜
(신문용지 54g/㎡)

이 신청은 아래와 같이 처리됩니다.



구비서류 : 1. 사업계획서 (별지 제28호의 2서식) 1부
2. 주택과 부대시설 및 복리시설의 배치도 1부
3. 건축법시행규칙 제2조의 규정에 의한도서 1부
(대지조성사업의 경우에는 대지조성공사 설계도서)
4. 도시계획법시행령 제25조제1항제4호 및 동령 제26조제2항제4호의 서류
(도시계획법상 일단의 주택지조성사업을 시행하거나 법 제34조의 규정에 의한 토지의 수용 또는 사용의 경우에 한함) 1부
5. 건축대지증명서 1부
6. 토지등기부등본 1부
7. 토지사용승락서 1부

(별지 제28호의 2서식) <개정 83.12.2 건설령 365 >

Site
1. 대지 □ 주택건설 □ 대지조성 사업계획서

①위치	②면적	③지역지구	④지목	⑤대지폭(m)	⑥등기명의자
location	area	zoning	designated land use	width 최저폭 / depth 최고폭	land owner

⑦대지현황	site characteristics
⑧주변현황	adjoining area (description)

※ 기재상 주의사항

1. ①란에는 필지별로 기재하되 (제곱미터) 다수필지일 경우에는 필지면적의 크기순으로 기재
2. ④란에는 지적법상 지적을, ③란에는 도시계획법상 용도를 구분 기재
3. ⑦란에는 기존건축물의 유무, 대지형태, 진입도로 (도시계획 도로포함) 고도, 경사각도, 입목유무등 현황을 기재
4. ⑧란에는 주변 100m이내의 주변사정을 알 수 있도록 기재

2805-01-46(6-1)A
80.10.6 승인
190㎜ × 268㎜
(신문용지 54g/㎡)

2. 주택 Dwellings

형별	세대당규모 ①전용면적 ②공용면적 ③계	④건축면적	⑤세대수	⑥동수	⑦층수	⑧구조	⑨건축연면적	공사기간 ⑩착공 ⑪준공
According to unit type	floor area (private & communal)	bldg. area	quantity	sep. blocks	storey	structural frame	tot. floor area	construction period

⑫침실 개수	면적	⑬부엌 개수	면적	⑭변소 개수	면적	⑮거실 개수	면적	⑯목욕탕 개수	면적
bedroom no.	area	kitchen no.	area	toilet no.	area	living rm. no.	area	bath no.	area

동별 구조	⑰층고	⑱최고높이	⑲반자높이	⑳발코니의유효폭	㉑복도의폭	㉒지하면적
	floor-to-floor ht.	bldg. ht.	ceiling ht.	clear depth of balcony	width of passage	basement area

㉓부속 건축물	ancillary bldg. or structure		
㉔외벽의 두께	thickness of external wall	㉕인접세대와의 사이벽의두께	thickness of adjoining wall
㉖지붕의 구조	type of roof structure		

2805-01-46(6-2)
80.10.6 승인
190㎜ × 268㎜
(신문용지 54g/㎡)

3. 사업비 및 자금계획 Construction Costs

①구 분	② 사업비계	주택건설사업비 ③ 대지비	④ 주택건축비	⑤부대복리시설 설치비	⑥ 간선시설 설치비	⑦ 계	일반분양 시설설치
Phase	tot. costs	site acquisition	bldgs.	welfare facilities	services		non-residential bldgs. for sale

8 자 금	9 사업비	10 사업주체자금	11 국민주택자금	12 금융기관등자금	13 기타자금	14 비고
finance		applicant's own	public housing fund	bank loan	other sources	remark

※ 기재상 유의사항

1. 1)란에는 단지별 또는 공구별로 순차적으로 건설하는 경우에 당해 단지 또는 공구명을 기재할 것.
2. ⑧란(주택가격에 포함되지 아니하는 시설)에는 해당시설 용지비를 포함시키되 주택단지내 부대복리시설을 공동으로 사용하는 경우에는 해당건축 연면적 비율로 산정할 것..
3. 15란에는 기타 자금의 내역을 명기할 것.

2805-01-46(6-3)A 190 ㎜×268 ㎜
80.10.6 승인 (신문용지 54g/㎡)

4. 부대시설 설치계획 Public Utilities & Services

종 류	① 현 황	설치계획 ②단지내	③단지외
		within estate	outside estate
④전 기	electricity		
⑤도 로	roads		
⑥상 하 수 도	water supply & sewerage		
⑦통 신 시 설	telecommunication		
⑧가스공급시설	gas		
⑨자동차정류소	parking provision		
⑩우 편 시 설	post boxes		
⑪관 리 사 무 실	management office		
⑫보 안 등	security lighting		
공공시설 동사무소	local admin. office		
공공시설 파 출 소	police station		
공공시설 우 체 국	post office		

※ 기재상 주의사항

1. ③란에는 영〔별표6〕간선시설의 종류별 설치범위에 따른 설치계획을 기재합니다.
2. ④란에는 세대별 용량과 적산전력계 설치 여부등을 기재합니다.
3. ⑤란에는 진입도로 및 단지내 도로의 설치개소·폭·길이등을 기재합니다.
4. ⑦란에는 세대별 전화국인입선의 설치여부와 공중전화의 설치 여부를 기재합니다.
5. ⑬란에는 기존시설의 단지로부터의 거리, 확보된 대지의 면적 등을 기재합니다.

2805-01-46(6-4)A 190 ㎜×268 ㎜
80.10.6 승인 (신문용지 54g/㎡)

5. 복리시설 설치계획 Welfare Facilities

종 류	① 설 치 계 획
② 어 린 이 놀 이 터	children playarea
③ 집 회 소	community centre
④ 운 동 장	sports ground
⑤ 비 상 저 수 시 설	emergency water storage
⑥ 공 원 또 는 녹 지 시 설	park
⑦ T·V 공 청 시 설	TV aerial
⑧ 공 동 저 탄 장 시 설	communal solid fuel storage
⑨ 노 인 정	elderly centre

※ 기재상 주의사항

1. 1.란에는 주택건설기준에 관한 규칙에 의하여 설치계획을 항목별로 명기합니다.
2. 시설설치의 필요가 없는 때에는 각란에 그 사유를 명기합니다.

2805-01-46 (6-5)A 190 ㎜×268 ㎜
80.10.6 승인 (신문용지 54g/㎡)

6. 일반분양시설 설치계획 Commercial Facilities

종 류	① 설 치 계 획
② 판 매 시 설	shops
③ 의 료 시 설	clinics
④ 공 중 목 욕 탕	communal baths
⑤ 체 육 시 설	sports facilities

※ 기재상 주의사항

1. 1)란에는 주택건설기준에 관한 규칙에 의하여 설치계획을 항목별로 명기합니다.
2. 시설설치의 필요가 없는 때에는 각란에 그 사유를 명기합니다.

2806-01-46(6-6)A 190 ㎜×268 ㎜
80.10.6 승인 (신문용지 54g/㎡)

(별지 제29호서식)〈개정 83.8.8 건설령 362〉

□주택건설 □대지조성 사 업 계 획 승 인 서 ①승인번호

사업주체	②상 호		③지정등록번호	
	④대 표 자		⑤영업소소재지	
설계자	⑥성 명		⑦자 격	
	⑧주 소			
공사시공자	⑨성 명		⑩자 격	
	⑪주 소			
사업계획	⑫사 업 위 치		⑬용도지역	지역지구

사업계획	⑭대지면적	⑮건축연면적	⑯주택형법	⑰규 모	⑱사업비
사 업 내 용			단독 연립 아파트	제곱미터형 동 세대	

사 업 기 간	⑲착공예정일자	⑳준공예정일자

㉑승인내역

주택건설촉진법 제33조 및 동법시행령 제32조의 규정에 의하여 주택건설사업계획을 승인함.

19 . . .

시 장
도지사 ㊞

2805-01-47A 190 ㎜×268 ㎜
80.10.6 승인 (신문용지 30g/㎡)

JAPAN (City of Nagoya) :

正　第一号様式正本（B5）

確認申請書 (建築物)

〔注意〕記入については副本の下欄の注意事項をよく読んで下さい。　※手数料欄

建築基準法第6条第1項の規定による確認を申請します。この申請書及び添附図書に記載の事項は事実に相違ありません。

昭和　年　月　日

申請者氏名　㊞　（ここに貼れない場合は裏面にお貼り下さい。）

1. 建築主住所氏名	client　電話　番
2. 代理者資格住所氏名 建築士事務所名	client's agent　reg. no. 登録第　号 (　) 建築士事務所　愛知県知事登録 (　) 第　号　電話　番
3. 設計者資格 住所氏名 建築士事務所名	(　) 建築士　(　) 登録第　号　㊞ architect　reg. no. (　) 建築士事務所　愛知県知事登録 (　) 第　号　電話　番
4. 建築設備に関し意見を聴いた者の住所氏名 勤務先名	mechanical consultant　電話　番
5. 工事監理者資格 住所氏名 建築士事務所名	(　) 建築士　(reg. no. 登録第　号　㊞ construction supervisor (　) 建築士事務所　愛知県知事登録 (　) 第　号　電話　番
6. 工事施工者住所氏名	建設業の許可 大臣 知事 (　) 第　号 contractor　電話　番
7. 確認の特例 conformation to bldg. bye-laws	1 建築基準法第6条の2第1項の規定による確認の特例の適用の有無　有・無 適用があるときは建築基準法施行令第13条の2各号に掲げる建築物の区分　第1号、第2号、第3号、第4号 2 建築基準法施行令第13条の2第1号又は第2号に掲げる住宅に該当するときは、当該住宅に係る型式指定番号　第　号
8. 敷地の位置 イ. 地名地番	名古屋市 site 区 location 町(通) (address) 丁目　番地
ロ. 用途地域	zoning
ハ. 防火地域	防火、準防火、指定なし fire zone　※ニ. その他の区域、地域、地区、街区
9. 主要用途	proposed use　10. 工事種別　新築、増築、改築、移転、用途変更、大規模の修繕、大規模の模様替　nature of the proposed operation

	申請部分	申請以外の部分	合 total 計	※ 14. 敷地面積との比
11. 敷地面積	site area		㎡	
12. 建築面積	bldg. area ㎡	㎡		/10
13. 延べ面積	tot. floor area ( )	( )	( )	/10

15. 工事着手予定日	昭和　年　月　日　construction period
16. 工事完了予定日	昭和　年　月　日
17. その他必要な事項	

18. 建築物別概要（第　号）

イ. 用途		ニ. 屋根	roof structure
ロ. 工事種別		ホ. 外壁	external wall
ハ. 構造	structural frame	ヘ. 軒裏	underside of the eave

階別	storey 階	階	階	階	合 total 計
ト. 床面積 申請部分	floor area detail ㎡	㎡	㎡	㎡	㎡
申請以外の部分					
合計					
チ. 柱の小径	the smallest diameter of the column cm	cm	cm	cm	ヲ. 最高の高さ　bldg. ht.　m
リ. 横架材間の垂直距離	vertical distance between beams m	m	m	m	ワ. 最高の軒の高さ　eave ht.
ヌ. 階の高さ	floor-to-floor ht.				カ. 居室の床の高さ　floor ht. of living room
ル. 居室の天井の高さ	ceiling ht. of living room				ヨ. 便所の種類　水洗・汲取(改良)　toilet type
タ. 建築設備の種類	浄化槽・換気・空調・非常用照明・換気・解錠・昇降機・非常用昇降機・自動消火・予備電源・避雷針・給水設備・排水設備・防火設備　mechanical systems				

※受付欄	※消防関係同意欄	※決裁欄		※確認番号欄
昭和　年　月　日		主事		昭和　年　月　日
第　—　号				第　—　号
係員印				係員印

裏面にも記入してください。

U.K. (Edinburgh District Council) :

City of Edinburgh District Council

Application for Planning Permission and/or Listed Building Consent

Form D1 Number ____

A helpful guide for completing this form is available at the Enquiry Office.

SECTION A

Note—Four application forms and three paper copies of plans of which two should be coloured to be lodged with **The Director of Planning, 18 Market Street** *together with all appropriate* **certificates and fees.** *Where the application involves alterations to an existing building, alterations should be shown coloured on all plans.*

APPLICATION for **PLANNING PERMISSION** and/or **LISTED BUILDING CONSENT** under the Town and Country Planning (Scotland) Acts, 1972/77 and the Town and Country Amenities Act, 1974.

To the **CITY OF EDINBURGH DISTRICT COUNCIL**

Name and address of applicant

I/We ____

hereby make application to the District Council for permission or consent

Please state nature of proposed development and—where permission is sought for a limited period only—the extent of that period. If application is for permission in outline, please say so.

to ____

Address or location of site of proposed development.

at ____

in accordance with the particulars given in this Form and with the plans which accompany this application.

The Planning Department will not register any application until all required procedures have been carried out by the applicant.

Signature of Applicant or Law Agent ____

Date ____

Fee Submitted £

FOR OFFICIAL USE

Section 24	Article 7	Article 7	Fees	Receipt Issued No Inls
Certificate of ownership or otherwise	Certificate	Dispensation Yes/No	Application	Fee Due £
	Parties listed	Advertisement Yes/No	Advertisement	Balance / Refund } Due £
Forms fully complete	Date of receipt of valid application ____			Balance Received £
Planning Committee's decision and date	Date decision sent to applicant/s	Appeal? / Date of hearing	Decision on appeal	Receipt issued No Inls Date
				Refund Instructed Date Inls

SECTION B (to be completed by Applicant)

1 Name, Address and Telephone Number (if any) of Applicant. Please use block capitals

Dr./Mr./Ms./Messrs ____

Other Name/s ____

Address ____

____ Postcode ____

Tel. No. ____

2 Name, Address and Telephone Number of Agent (if any) acting on Applicants behalf.

Name ____

Address ____

____ Postcode ____

Profession ____

Tel. No. ____

3 a) Has the existing building been enlarged since 1st July 1948? (If 'yes' the enlargement should be shown on the plans) Answer 'yes' or 'no' ____

3 b) What is the present cubic content of the building? ____

3 c) What is the estimated cost of any works to be carried out? ____

4 If building operations are proposed, give description of materials including colour

a) outside walls (mention any special finishes) ____

b) roof covering ____ c) boundary walls or fences ____

5 In the case of the proposed construction of a new or improved access to or from a road, state the purpose for which the access is required (eg., for pedestrian or vehicular traffic)

____

6 In the case where a change of use of land or a building is proposed.

a) State the present use (or uses) of the land or building. If there is (or was) more than one use, indicate the part allocated to each use.

____

b) State the proposed new use, or where more than one use is proposed, state the new uses and indicate the part of the land or building allocated to each use.

____

c) State any previous changes of use (or uses) since 1st July 1948.

____

7 Any further particulars to which Applicant desires to draw attention

____

SECTION C

Certification under S.24 of the Town and Country Planning (Scotland) Act 1972 (Site Ownership).

One of Certificates A, B or C will apply. Please sign and date it and delete the others.
"Owner" means any person who, in respect of any part of the land, is the proprietor of the dominium utile, or is the lessee under a lease thereof of which not less than 7 years remains unexpired.

One of the Agricultural Holding Certificates must also be signed.

Certificate A
I hereby certify that I am*/the applicant is* the owner of every part of the land to which this application relates, and that no person other than the applicant was the owner of the land 21 days before the date of this application.

Signed ______________________

Date ______________________

or **CERTIFICATE B** (applicant not the owner)
I hereby certify that I have*/the applicant has* given the requisite notice to all persons who, 21 days before the date of the accompanying application, were owners of any of the land to which this application refers. viz:—

Name & Address of owner(s)	Date of Service of Notice

Signed ____________ Date ____________

Certificate C
I hereby certify that I am*/the applicant is* unable to issue Certificate A or B under S.24. I have given the requisite notice to the owners I have traced, viz:—

Name & Address of Owner(s)	Date of Service of Notice

I have*/applicant has* taken the following steps to find out the names and addresses of the owners, but was unable to do so:—

____

____

Because not all the owners can be traced, notice of the application has been published in the *Evening News* on Friday ________ (date of publication must not be earlier than 21 days before the date of the planning application). A copy of the Notice as published is attached.

Signed ____________ Date ____________

Agricultural Holding Certification

One of the following certificates must be signed.

I further certify that none of the land to which the application relates constitutes or forms part of an agricultural holding.

Signed ____________ Date ____________

or I further certify that I have*/the applicant has* given the requisite notice to every person who, 21 days before the date of this application, was a tenant of any agricultural holding any part of which was comprised in the land to which this application relates:

Name and Address of Agricultural Tenants	Date of Service of Notice

Signed ____________ Date ____________

* delete inapplicable

SECTION D

Town and Country Planning (Scotland) Act 1972
Town and Country Planning (General Development) (Scotland) Orders 1981 to 1984
Certificate Under Article 7(3) (Neighbours)

[If the application is for Listed Building Consent **only**, you do not complete this section]

You must complete the Certificate which applies to your case. *Delete inapplicable.

I hereby certify that I have*/the applicant has* in accordance with Article 7(3) given the requisite notice to all parties (listed below ‡) who hold a notifiable interest in neighbouring land.

____

OR* I hereby certify that no notification is required in accordance with Article 7(3) since there are no parties holding a notifiable interest in neighbouring land.

____

OR* I hereby certify that I have*/the applicant has* taken the steps listed below at X to ascertain the name(s) and address(es) of the parties holding a notifiable interest in neighbouring land but have*/has* not been able to ascertain their name(s) and address(es)

____

OR* I hereby certify that I have*/the applicant has* in accordance with Article 7(3) given the requisite notice to such parties (listed below ‡) holding a notifiable interest in neighbouring land as I have been able to ascertain, and I have*/the applicant has* also taken the steps listed at X to ascertain the names and addresses of other parties holding a notifiable interest in neighbouring land as aforesaid but have*/has* been unable to find out the name and address of one or more of such parties.

X The steps taken are as follows: ______________________

____

Delete if inappropriate
[For the purposes of this certificate the planning authority has dispensed with the requirement to notify neighbours across a road not exceeding 20m, viz: (a) ______________________

____

(a) details of the neighbouring land to which this dispensation applies]

‡ If you have served notice on any neighbours, you must complete this list. The names and addresses of those I have notified are as follows:—

Name	Address

Under s 23(3) and s 24 of the Town and Country Planning (Scotland) Act 1972, any person who knowingly or recklessly supplies a certificate under Section C or Section D (above) which is false or misleading, is guilty of an offence and liable on summary conviction to a fine not exceeding £400.

Name of applicant ______________________

Address ______________________

____

Signature ______________________

* On behalf of ______________________

Date ______________________

If signature is not that of applicant, give name and address of the signatory and the capacity in which s/he acts:

____

____

____

____

FORM 6

THE CITY OF EDINBURGH DISTRICT COUNCIL

[See Note 1]

APPLICATION FOR WARRANT TO ERECT (INCLUDING A BUILDING INTENDED TO HAVE A LIMITED LIFE), ALTER, EXTEND, CHANGE THE USE OF OR DEMOLISH A BUILDING

Building (Scotland) Acts 1959 and 1970

TO THE CITY OF EDINBURGH DISTRICT COUNCIL AS LOCAL AUTHORITY FOR THE PURPOSES OF THE BUILDING (SCOTLAND) ACTS 1959 AND 1970 FOR THE EDINBURGH DISTRICT AREA

Insert here full name(s) and address(es) of applicant(s)

I/We ....

....

....

apply under section 6 of the Building (Scotland) Act 1959 as amended by the Building (Scotland) Act 1970 and the Local Government (Scotland) Act 1973 for a warrant for the ....

State here the nature of the proposed operations, e.g. erection, alteration, extension, change of use [See Note 2] or demolition of house, shop or other building

....

Insert here address of site or building

[forming part of the building at]* ....

....

State interest in building, e.g. owner, tenant

of which I am/we are..

all in conformity with the plans, [sections, elevations and drawings] [and specifications and other statements]* produced herewith [and in accordance with the relevant particulars given in the Schedule hereto]* [such building being intended to have a life of .... years]*.

[See Note 3]

[See Note 5]

[I/We also apply for permission under section 8 of the Building (Scotland) Act 1959 as amended by the Building (Scotland) Act 1970 and the Local Government (Scotland) Act 1973 to occupy temporarily, for the purpose of depositing materials or otherwise in connection with the operations referred to above, the portion of .... shown in the said plans and for authority under the said section 8 as amended to erect staging or scaffolding so as to project over the portion of .... shown in said plans]*.

Insert name of road which must be adjacent to the building or site

Insert name of road which must be adjacent to the building or site

Signature of applicant or agent..

Date..

* Delete as appropriate

57—10M/6/83—08162/00451

Name and address of agent (if any) acting on the applicant's behalf.

Name ....

Address ....

Telephone No. ....

Profession ....

SCHEDULE

Particulars of Application

Note: *Where the application is in respect of a warrant to demolish, sections 5 and 6 only need be completed. In all other cases sections 1 to 5 should be completed.*

1. Has any direction been given by the Secretary of State or the local authority under section 4 of the Building (Scotland) Act 1959 as substituted by section 2(1) of the Building (Scotland) Act 1970?

   If so give details including the date and reference number of the direction. ....

   ....

2. What is the estimated cost of the operations? Please note that the local authority may wish to verify this figure. ....

3. (*a*) What is

   (i) the proposed use, and

   (ii) (if applicable) the existing use of the [building] [part of the building covered by the application]*

   (Where more than one use is proposed state the uses and indicate the part of the building allocated to each use.)

   (i) ....

   ....

   ....

   (ii) ....

   ....

   ....

   ....

   ....

   [(*b*) State the provisions of the Building Standards (Scotland) Regulations 1981 and 1982 which will become applicable or will apply more onerously to the building or part thereof by reason of the change of use]*.

   ....

   ....

   ....

   ....

   ....

[See Note 4]

4. Is it intended that a further application will be made to the local authority in respect of any stage or stages in the construction for which particulars are not submitted with this application? If so please indicate stage(s).

   ....

   ....

   ....

   ....

[See Note 6]

5. If the application is in respect of an existing building state whether it is listed under the Town and Country Planning (Scotland) Act 1972 as being of special architectural or historic interest. If so please state category.

   ....

   ....

   ....

   ....

Demolitions Only

6. Give such particulars as are necessary to show that the operations involved will be conducted in accordance with the Building (Operations) (Scotland) Regulations 1975 [and any direction issued by the local authority under those regulations]*, so far as such particulars are not shown in the plan produced with the application.

   ....

   ....

   ....

   ....

   ....

   ....

   ....

   ....

* Delete as appropriate

USA (Fairfax County, VA) :

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
FAIRFAX COUNTY, VIRGINIA
PERMIT APPLICATION CENTER
10555 MAIN STREET, 4TH FLOOR
FAIRFAX, VA. 22030 691-3031

BUILDING PERMIT APPLICATION

APPLICATION NO

______ 19 ___
Date

JOB LOCATION
Street ______
Building ______ Floor ______ Suite ______
Subdivision ______
Tenants Name ______

DO NOT WRITE IN THIS SPACE
Permit No. ______
Map Reference ______
Building Permit No. ______ Control No. ______
Std. ______ Mag. ______ Plan ______ Census ______

OWNER
Name ______
Address (Mailing) ______
City ______ State ______ Zip ______
Telephone ______

CONTRACTOR
Company Name ______
Master ______
Address ______
City ______ State ______ Zip ______
Telephone ______ License No. ______
State Contractors License No. ______
County Business Account No. ______

Description
For ______

Model/Use ______

Sewage: Public ☐ Community ☐ Septic Tank ☐ None ☐
WATER: Public ☐ Individual Well ☐ None ☐

☐ N-New ☐ D-Demolish
☐ R-Alter or Repair ☐ M-Move
☐ A-Add To ☐ O-Other

REMARKS:

ROUTING

	Date	Approved By:
Health Review		
Site Review		
Zoning Review		
Sanitation Review		
Building Review		
Fire Review		

BUILDING DESCRIPTION — QUANTITY
Units ______
Stories ______
Rooms ______
Bedrooms ______
To be Added ______
Baths ______
Half Baths ______
Kitchens ______
Fireplaces ______
Basement ______
% Basements to Finish ______

Use Group of Building ______
Type of Construction ______
Building Area ______
Estimated Const. Cost ______

ZONING REVIEW
Zoning Proffers Building ______
Zoning Class ______
Zoning Case # ______

BUILDING CHARACTERISTICS
Building Height ______
Exterior Walls ______
Interior Walls ______
Roofing Material ______
Flooring Material ______
Heating Fuel ______
Heating System ______

GRADING AND DRAINAGE REVIEW
Soils ______
Historical ______
Plan # ______
Retaining Wall ______

BUILDING DIMENSIONS				
No. Stories	Width		Depth	Sq. Ft.
		x		=
		x		=
		x		=
		x		=

YARDS Front ______ Front ______ Left Side ______ Right Side ______ Rear ______

REMARKS ______

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
FAIRFAX COUNTY, VIRGINIA
PERMIT APPLICATION CENTER
10555 MAIN STREET, 4TH FLOOR
FAIRFAX, VA. 22030 691-3031

SMALL APPLIANCE APPLICATION

______ 19 ___
Date

JOB LOCATION
Street ______
Building ______ Floor ______ Suite ______
Subdivision ______
Tenants Name ______

DO NOT WRITE IN THIS SPACE
Permit No. ______
Map Reference ______
Building Permit No. ______ Control No. ______
Std ______ Mag ______ Plan ______ Census ______

OWNER
Name ______
Address (Mailing) ______
City ______ State ______ Zip ______
Telephone ______

CONTRACTOR
Company Name ______
Master ______
Address ______
City ______ State ______ Zip ______
Telephone ______ License No. ______
State Contractors License No. ______
County Business Account No. ______

EQUIPMENT: New ☐ Replacement ☐

LIST BELOW THE ITEMS TO BE INSTALLED

CODE	QUANTITY	DESCRIPTION	CODE	QUANTITY	DESCRIPTION
01		Air Conditioner	21		Light Fixture
02		Air Filter	22		Oven Elec
03		Bath Tub	23		Oven Gas
04		Boiler Elec	24		Prefab Fireplace
05		Boiler Gas	25		Range Elec
06		Boiler Oil	26		Range Gas
07		Compactor	27		Shower
08		Dishwasher	28		Sink
09		Disposal	29		Smoke Detector
10		Dryer Elec	30		Sump Pump
11		Dryer Gas	31		Surface Unit Elec
12		Fan Attic	32		Surface Unit Gas
13		Fan Exhaust	33		Vent Damper
14		Furnace Elec	34		Water Closet
15		Furnace Gas	35		Water Heater Elec
16		Furnace Oil	36		Water Heater Gas
17		Humidifier	37		Water Softener
18		Ice Maker	38		Wood Heater
19		Laundry Tub	99		Other Appliances
20		Lavatory			

TOTAL FEE: $ ______

COMMENTS:

PRIVACY NOTICE. The request for and the use of personal information on this form is subject to the provisions of the Privacy Act of 1974 and the Freedom of Information Act

______
Signature of Master, Agent or Owner

READ REVERSE SIDE

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
FAIRFAX COUNTY, VIRGINIA
PERMIT APPLICATION CENTER
10555 MAIN STREET, 4TH FLOOR
FAIRFAX, VA. 22030 691-3031

MECHANICAL APPLICATION

APPLICATION NO ______ 19 ____ Date

JOB LOCATION
Street ______
Building ______ Floor ______ Suite ______
Subdivision ______
Tenants Name ______

DO NOT WRITE IN THIS SPACE
Permit No. ______
Map Reference ______
Building Permit No. ______ Control No. ______
Std. ______ Mag. ______ Plan ______ Census ______

OWNER
Name ______
Address (Mailing) ______
City ______ State ______ Zip ______
Telephone ______

CONTRACTOR
Company Name ______
Master ______
Address ______
City ______ State ______ Zip ______
Telephone ______ License No. ______
State Contractors License No. ______
County Business Account No. ______

EQUIPMENT: New ☐ Replacement ☐ TYPE OF BUILDING: New ☐ Old ☐ Add'n. ☐
C. Contract Value: ______ Value of Listed Equipment ______

Approved ______ Date ______

Items are coded by the type work as follows:
R Residential, C Commercial, E Elevator, F Fire or Combinations

LIST BELOW THE ITEMS TO BE INSTALLED

TYPE	DESCRIPTION	CODE	RATING	QTY	TYPE	DESCRIPTION	CODE	RATING	QTY.
R	Fire Place - PREFAB	M 23			R-C	Unit Heater Elec-KW	M 59		
R	Woodstove	M 63			R-C	Unit Heater Gas-MBH	M 60		
R-C	Boiler-HW Heat-MBH	M 05			R-C	Unit Heater Oil-MBH	M 61		
R-C	Boiler Miniature	M 07			C	Air Comp Rec Tnk	M 01		
R-C	Boiler Repair	M 10			C	Auto Hydraulic Lift	M 04		
R-C	Chimney - PREFAB	M 12			C	Boiler-HW- Sup-MBH	M 06		
R-C	Ducts	M 14			C	Boiler Power - HP	M 08		
R-C	Expansion Tank	M 20			C	Boiler Steam - LBS	M 09		
R-C	Furnace Elec - KW	M-25			C	Chiller - TON	M 11		
R-C	Furnace Gas - MBH	M 26			C	Converter Steam-HWM	M 13		
R-C	Furnace Oil - MBH	M 27			C	Furnace Duct - MBH	M 24		
R-C	Furnace/Solid Fuel-MHB	M 28			C	Incinerator - LBS	M 36		
R-C	Air Condition - TONS	M 31			C	Oil Burner No. 5/6	M 42		
R-C	Heat Pump - TONS	M 32			C	Refrigeration - TON	M 49		
R-C	Ht Pump/Aux Ht MBH	M 64			C	Refrigerant Receiver	M 50		
R-C	HW-Storage Tank-SF	M 33			C	Steam Blowoff Tank	M 54		
R-C	HW - Tankless Heater	M 34			C	Tanks Gas	M 55		
R-C	Indirect HW Heater	M 37			C	Unfired Pres Ves	M 58		
E-R	Lift Priv/Handicap	M 39			E	Dumbwaiter Hand	M 15		
R-C	Oil Burner No. 1/2/4	M 41			E	Dumbwaiter Power	M 16		
F-R-C	Piping of Equipment	M 44			E	Elevator Freight Fl	M 17		
C	Pump - Fuel Oil	M 46			E	Elevator Passngr Fl	M 18		
C	Pump - Water Circ	M 47			E	Escalator Fl	M 19		
R-C	Solar Heat-NO CHRG	M 52			E	Manlift	M 40		
R-C	Tanks Oil	M 56			F	Fire Alarm System	T 01		
R-C	Tanks Propane	M 57			F	Fire Det/Ext Test	T 02		
C	Vent Smoke Pipe	M 62			F	Halon System	M 30		
					F	Limited Fire - D/E	T 03		
					F	Range Hood Fire Pro	M 48		
					F	Fire Marshall Test	999		

COMMENTS: ______

TOTAL FEE: $ ______

PRIVACY NOTICE: The request for and the use of personal information on this form is subject to the provisions of the Privacy Act of 1976 and the Freedom of Information Act.

______
Signature of Master or Agent

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
FAIRFAX COUNTY, VIRGINIA
PERMIT APPLICATION CENTER
10555 MAIN STREET, 4TH FLOOR
FAIRFAX, VA. 22030 691-3031

PLUMBING AND/OR GAS INSTALLATION

APPLICATION NO. ______ 19 ____ Date

JOB LOCATION
Street ______
Building ______ Floor ______ Suite ______
Subdivision ______
Tenants Name ______

DO NOT WRITE IN THIS SPACE
Permit No. ______
Map Reference ______
Building Permit No. ______ Control No. ______
Std. ______ Mag. ______ Plan ______ Census ______

OWNER
Name ______
Address (Mailing) ______
City ______ State ______ Zip ______
Telephone ______

CONTRACTOR
Company Name ______
Master ______
Address ______
City ______ State ______ Zip ______
Telephone ______ License No. ______
State Contractors License No. ______
County Business Account No. ______

EQUIPMENT: New ☐ Replacement ☐ Type of Building: New ☐ Old ☐ Add'n. ☐ S/F ☐ TH☐ Condo ☐ Other ☐
HAZARD CODE: ☐ SPRINKLER SYSTEM VALUE: ______

LIST BELOW THE ITEMS TO BE INSTALLED

CODE	QUANTITY	DESCRIPTION	CODE	QUANTITY	DESCRIPTION
F 01		Air Conditioner	F 37		Service Sink
F 02		Area Drain	F 40		Shampoo Basin
F 03		Backflow/Press/Prevt	F 41		Shower
F 04		Bar Sink	F 42		Sink
F 05		Basin	F 43		Sitzbath
F 06		Bidet	F 44		Space Heater
F 07		Boiler	F 45		Sprinkler Head Potable
F 08		Case Drain	F 48		Submeter
F 09		Clinic Sink	F 49		Surface Unit
F 10		Coffee Urn	F 50		Temp Press Rel Val
F 11		Dental Chair	F 51		Trailer Sewer Connect
F 12		Dishwasher	F 52		Trailer Water Connect
F 13		Dryer	F 53		Tub
F 14		Floor Sink	F 54		Urinal
F 15		Floor/Trench Drain	F 55		Vacuum Sys-Medical
F 16		Fountain	F 56		Wall Oven
F 17		Furnace Gas	F 57		Washing Machine
F 18		Garbage Disposal	F 58		Water Closet
F 19		Gas Bunsen Burner	F 59		Water Heater Elec
F 20		Gas Grill	F 60		Water Heater Gas
F 21		Gas Log Lighter	F 61		Water Treatment Equip
F 22		Gas Log	F 62		Wet Stack
F 23		Gas Miscellaneous	F 63		Yard Hydrant
F 24		Gas Pool Heater	F 99		Other Fixtures
F 25		Gas Relocate Meter	S 01		Building Sewer-San
F 26		Gas Roof Top Unit	S 02		Cap Off/Sewer-San
F 27		Hose Bib/Wall Hydrnt	S 03		On Site Sewer-San
F 28		Hot Tub	S 04		On Site Water
F 29		Humidifier	S 05		Sewer Tap-San
F 30		Ice Maker	S 06		Storm Sewer
F 31		Laundry Tray	S 07		Water Service
F 32		Lawn Sprinkler Sys	S 08		Sewer Eject Pump Com
F 33		Plumbing Misc	S 09		Sewer Eject Pump Dom
F 34		Pressure Rel. Valve	999		Fire Marshall Test
F 35		Range Gas			
F 36		Roof Drain			

TOTAL FEE: $ ______

APPLICATION FOR SEWERAGE SERVICE

Is developer extending sewer line? Yes ☐ No ☐
If *no* a. Must private property be crossed to get access to sewer? Yes ☐ No ☐
b. Is easement recorded? Yes ☐ No ☐

	PAID	FEE
Availability		
Connection		

W. GERMANY (City of Aachen) :

Der Oberstadtdirektor
- Untere Bauaufsichtsbehörde -
Lagerhausstraße 20

5100 Aachen

Eingang
- Bauaufsichtsbehörde -

☐ Bauantrag (Genehmigungsverfahren nach § 60 Abs. 1 BauO NW) ☐ Bauantrag (Vereinfachtes Genehmigungsverfahren nach § 64 BauO NW) ☐ Antrag auf Vorbescheid

☐ ______ ______ Antragsdatum

		Bauherr	Entwurfsverfasser	Bauleiter[1]
I	Zuname *name*	*client*	*architect*	*contractor*
	Vorname			
	Stellung im Beruf[1]	*occupation*		
	Wohnung, Str., Nr.	*address*		
	(PLZ) Wohnort	*city*		
	Fernruf Nr.	*telephone*		

II Baugrundstück *site*
Straße, Haus-Nr.: *location* Gemeinde: *city*
Gemarkung: ______ Flur: ______ Flurstück: ______

III Errichtung *proposed use*
☐ Einfamilienhaus *bungalow* ☐ gewerbl. Vorhaben *commercial* ☐ *no. households* Wohneinheiten
☐ Mehrfamilienhaus *multi-family* ☐ sonstige Vorhaben *other use* ☐ Garage(n) *garages*
☐ Wohn- und Geschäftshaus *house/shop in service* ☐ ______ ☐ Stellplätze *on-street parking*
☐ landwirtschl. Vorhaben *farm bldg.* ☐ Einfriedigung *fencing*
Genaue Bezeichnung: ______

IV Änderungen *amendment*
☐ Abbruch *demolition* ☐ Aufstockung *extension (vertical)* ☐ Änderung der äußeren Gestaltung
☐ Umbau *remodelling* ☐ Erweiterung *" (horizontal)* ☐ Nutzungsänderung *change of use*
☐ Instandsetzung *alteration* ☐ Dachgeschoßausbau *roof-top floor* ☐ sonstige Vorhaben *other*
Genaue Bezeichnung: ______

V Haus- und Grundstückseinrichtungen *Services (sewerage, refuse disposal, heating source, fencing)*
☐ Grundstücksentwässerung mit ☐ Anschluß an Sammelkanal ☐ Kleinkläranlage ☐ Sonstige Entwässerung
☐ Feuerungsanlage für ☐ feste Brennst. ☐ Heizöl ☐ Gas
Nennwärmeleistung ______ kW
☐ Lagerbehälter für ☐ Heizöl ☐ Flüssiggas ☐ Sonstiges
Rauminhalt ______ l ☐ unterirdisch ☐ oberirdisch ☐ im Gebäude
☐ Einfriedigung ☐ Sonstige Anlage ______
Genaue Bezeichnung: ______

VI Ein Vorbescheid wurde / nicht / erteilt. *Preliminary review*
Vorbescheid vom *date*, Aktenzeichen: *file number*

VII Bindungen für die Beurteilung des Vorhabens
☐ Teilungsgenehmigung ☐ Heimstätte ☐ Bauherr ist nicht Eigentümer- oder Erbbauberechtigter des Baugrundstückes
☐ Baulast ☐ Kleinsiedlung
☐ ______ ☐ Wohnungsbauförderungsmittel wurden/werden beantragt ☐ sonstige Bindungen
Genaue Bezeichnung: ______

VIII Kosten *Estimated Cost*
Rohbaukosten: *cost for bldg. structure* Herstellungskosten (reine Baukosten): *net construction costs*
Herstellungskosten f. Anlagen und Einrichtungen: *ancillary costs*

1) Angabe gem. 2 BauStatG v. 27.7.78 (BGBl I S. 1118)

A 63/01 B - 3

IX Falls der Bauherr nicht Eigentümer des Baugrundstückes ist: *in case that the client is not the land owner*
Grundstückseigentümer: *land owner*
(Name, Anschrift, Telefon)

X Genaue Fragestellung für den Antrag auf Vorbescheid gem. § 66 BauO NW: (ggf auf bes. Blatt)
conformation to bldg. bye-laws

XI NOTWENDIGER KINDERSPIELPLATZ nach BauO NW in Verbindung mit der Satzung der Stadt Aachen *playground*
Mindestgröße *minimum size* 30 qm
Bei mehr als 5 anrechnungspflichtigen Wohnungen zusätzlich je WE 5 qm,
demnach *no. household* WE x 5 qm = ______ qm
zus. = *total* ______ qm
Gilt nur für Gebäude mit mehr als 3 kindergerechten Wohnungen

XII Baumbestand: *planting*
Ist auf dem Baugrundstück und auf den unmittelbar angrenzenden Nachbargrundstücken geschützter Baumbestand vorhanden? Neben Naturdenkmälern gehört hierzu auch der nach § 1 der Baumschutzsatzung der Stadt Aachen in der derzeit geltenden Fassung geschützte Baumbestand.
ja ☐ nein ☐
Wenn ja, im Lageplan eintragen.
Auf das vom Bauordnungsamt hierzu herausgegebene Merkblatt wird verwiesen.

Die Vorlage einer 3. Ausfertigung der auf Seite 3 unter A 1., 4. u. 5. genannten Bauvorlagen ist bei Vorhaben, für die ein Standsicherheitsnachweis erforderlich ist, unbedingt notwendig.

- 2 -

An den
Oberstadtdirektor
der Stadt Aachen
-Bauordnungsamt-

Geheimhaltung:

Einzelangaben werden gemäß § 12 Abs. 1 des Gesetzes über die Statistik für Bundeszwecke (BGBl. 1953 I S. 1314) geheimgehalten.
Nach § 12 Abs. 2 dieses Gesetzes dürfen die aus der Weiterleitung von Einzelangaben gewonnenen Erkenntnisse an die fachlich zuständigen Behörden nicht zu Maßnahmen gegen den einzelnen Auskunftspflichtigen verwendet werden. Eine Weiterleitung von Einzelangaben zu steuerlichen Zwecken ist ausgeschlossen.

E r h e b u n g s b o g e n
für Baugenehmigung/Bauanzeige

Rechtsgrundlage: 2. BauStatG vom 27. Juli 1978 (BGBl. I S. 1118).

*) Alten Zustand bitte nur bei Baumaßnahmen an bestehenden Gebäuden angeben.

**) Diese Felder werden von der Bauaufsichtsbehörde ausgefüllt!

n i c h t a u s f ü l l e n !	
Bau-Schein-Nr.:	M / J
Datum der Genehmigung	

1 Allgemeine Angaben

Name/Firma des Bauherren: client

Anschrift: address

Lage des Baugrundstückes

Kreis	Aachen-Stadt	3 1 3	10–12
Gemeinde	Aachen	0 0 0	19–21
Gemeindeteil	----------	- - -	22–24
Straße, Nr.			
Flur:			
Flurstück:			

2 Art des Gebäudes (bitte künftige Nutzung angeben) Bldg type

Wohngebäude (ohne Wohnheim) houses

	Bitte ankreuzen
ohne Eigentumswohnungen	1
mit Eigentumswohnungen	2
Wohnheim für dormitory	
Studenten	3
Pflegepersonal	4
Andere Berufstätige	5
Alters Menschen	6
Sonstige Gruppen	7

Nichtwohngebäude non-residential bldgs.
(bitte Art angeben)

**) 28–30

(z. B. Bürogebäude, Werkshalle, Kirche, Schule)

Wohnungen
(nach der Zahl der Räume einschl. Küchen)

mit no. bedspace	Anzahl neuer Zustand	alter Zustand*)
1 Raum	12	20
2 Räumen	13	21
3 Räumen	14	22
4 Räumen	15	23
5 Räumen	16	24
6 Räumen	17	25
7 und mehr Räumen	18	26
Zahl der Räume in Wohnungen mit 7 und mehr Räumen	19	27

Von den Wohnungen sind

	neuer Zustand
vom Bauherren bzw. künftigen Erwerber eigengenutzte Wohnungen	28
Wohnungen mit kitchen, bath, shower, toilet — Kochnische/Kochgelegenheit	29
Zweitem Bad bzw. getrenntem Duschraum	30
Zweit-WC	31

3 Art der Bautätigkeit Nature of the proposed operations

Errichtung eines neuen Gebäudes erection

	Bitte ankreuzen
in konventioneller Bauart	1
im Fertigteilbau	2
Baumaßnahme an einem bestehenden Gebäude extension	3

4 Größe des Zugangs

Bei Errichtung eines neuen Gebäudes erection

	m²/m³/Anzahl
Grundstücksfläche (§ 19 Abs. 3 BauNVO)	01 site area
Grundfläche (§ 19 Abs. 2 u. 4 BauNVO)	02 bldg. area
Geschoßfläche (§ 20 Abs. 2 u. 3 BauNVO)	03 tot. floor area
Rauminhalt – Brutto (DIN 277)	04 cubic content
Zahl der Vollgeschosse (nach LBO)	05 no. storey

Bei allen Baumaßnahmen other

	neuer Zustand	alter Zustand*)
Nutzfläche in m² (DIN 277: o. Wohnfläche)	06 ancillary area	
Wohnfläche in m² (DIN 283) der Wohnungen	07 unit floor area (net usable)	
der sonst. Wohneinheiten		11

Für jedes Gebäude und für jede Baumaßnahme an einem bestehenden Gebäude ist ein gesonderter Erhebungsbogen anzulegen.
Bei Nutzungsänderung ganzer Gebäude bitte zusätzlich einen Abgangsbogen ausfüllen.

	neuer Zustand	alter Zustand*)
Sonstige Wohneinheiten	32	34
Räume in sonstigen Wohneinheiten	33	35

5 Größe der Räume room size
in Wohnungen und sonstigen Wohneinheiten

	Anzahl neuer Zustand	alter Zustand*)
Küchen		
bis unter 6 m²	36	45
6 bis unter 12 m²	37	46
12 m² und mehr	38	47
Zimmer (über 6 m²)		
bis unter 10 m²	39	48
10 bis unter 15 m²	40	49
15 bis unter 20 m²	41	50
20 bis unter 25 m²	42	51
25 m² und mehr	43	52
Einzelzimmer über 6 m² außerhalb von Wohneinheiten	44	53

6 Veranschlagte Kosten des Bauwerkes estimated cost
(siehe DIN 276)

1 000 DM
54

Bitte auch Rückseite ausfüllen!

R 156

Ergänzende Angaben zum Erhebungsbogen Baugenehmigung

Zu 1 (Allgemeine Angaben)
Der Bauherr zählt zu den type of client KA 3 Lsp. I

Öffentlichen Bauherren (public) — Bitte ankreuzen

Bund	01
Länder	02
Gemeinden und Gemeindeverbände	03
Sozialversicherung	04

Unternehmen type of developer

Gemeinnützige Wohnungs- und ländliche Siedlungsunternehmen	05
Sonstige Wohnungsunternehmen	06
Immobilienfonds	07
Sonstige Unternehmen (ohne Wohnungsunternehmen)	
Land- und Forstwirtschaft, Tierhaltung, Fischerei	08
Produzierendes Gewerbe	09
Handel, Kreditinstitute und Versicherungsgewerbe, Dienstleistungen	10
Verkehr und Nachrichtenübermittlung (ohne Bundesbahn und Bundespost)	11
Bundesbahn und Bundespost	12

Privaten Haushalten type of client (private individual)

Selbständige	13
Beamte, Angestellte	14
Arbeiter	15
Rentner, Pensionäre	16
Sonstige private Haushalte	17
Organisationen ohne Erwerbscharakter	18 — 12–13

Der Bauherr ist Sanierungsträger (§ 33 StBauFG)	ja 1 / nein 2	14

Das Baugrundstück liegt
(Bei allen Baumaßnahmen)

in einem förmlich festgelegten Sanierungsgebiet (§ 5 StBauFG)	1
in einem Ersatz- bzw. Ergänzungsgebiet (§ 11 StBauFG)	2
in einem städtebaulichen Entwicklungsbereich (§ 53 StBauFG)	3
außerhalb der genannten Gebiete	4 — 15

(Nur bei Errichtung eines neuen Gebäudes)

a) im Geltungsbereich eines qualifizierten Bebauungsplans (§§ 30, 33 BBauG) — 1

innerhalb von im Zusammenhang bebauten Ortsteilen (§ 34 BBauG)	
mit einfachem Bebauungsplan	2
ohne Bebauungsplan	3
im Außenbereich (§ 35 BBauG)	4 — 16

b) sofern ein Bebauungsplan mit Baugebietsfestsetzung nach BauNVO vorliegt
in einem

Kleinsiedlungsgebiet	(WS)	01
reinen Wohngebiet	(WR)	02
allgemeinen Wohngebiet	(WA)	03
besonderen Wohngebiet	(WB)	04
Dorfgebiet	(MD)	05
Mischgebiet	(MI)	06
Kerngebiet	(MK)	07
Gewerbegebiet	(GE)	08
Industriegebiet	(GI)	09
Sondergebiet für Erholung	(SO, § 10 BauNVO)	10
sonstigen Sondergebiet	(SO, § 11 BauNVO)	11 — 17–18

oder sofern kein Bebauungsplan mit Baugebietsfestsetzung nach BauNVO vorliegt: Die Eigenart der näheren Umgebung entspricht einem

Wohngebiet	(W)	1
Dorfgebiet	(M)	2
Mischgebiet	(M)	3
Gewerbegebiet	(G)	4
Sondergebiet	(S)	5 — 19

nicht ausfüllen!

Zu 2 (Art des Gebäudes)
Bei Errichtung eines neuen Wohngebäudes new development (erection)
Das Wohngebäude dient Ferien-, Wochenend-, Erholungszwecken — ja 1 / nein 2 — 20

Haustyp des Wohngebäudes housing form
Einzelhaus (1) Gereihtes Haus (3)
Doppelhaus (2) Sonst. Haustyp (4) — 21

Bei allen neu zu errichtenden Gebäuden
Art der Konstruktion structure type
Skelettbau (1) Massivbau (2) — 22

Überwiegend verwendeter Baustoff bldg material (for structural purpose)
Stahl (1) Sonst. Mauerstein (4)
Stahlbeton (2) Holz (5)
Ziegel (3) Sonstiges (6) — 23

Unterkellerung foundation
keine (1) mit 1 Untergeschoß (2)
mit 2 und mehr Untergeschossen (3) — 24

Abwasserablauf direkt in Sewerage
Öff. Kanalisation mit Klärwerk (1)
Öff. Kanalisation ohne Klärwerk (2)
Kleinkläranlage (DIN 4261) (3)
Sonstige Abwasserbehandlungsanlage (4)
Grube, Behälter u. a. (5)
ohne Abwasseranschluß (6) — 25

Art der Beheizung heating method
Fernheizung (1) Etagenheizung (4)
Blockheizung (2) Einzelraumheizung (5)
Zentralheizung (3) keine Heizung (6) — 26

Vorwiegende Heizenergie heating source
Koks/Kohle (1) Fernwärme (5)
Öl (2) Wärmepumpe (6)
Gas (3) Solarenergie (7)
Strom (4) Sonstige (8) — 27

Klimaanlage air-conditioning — ja 1 / nein 2 — 28

Zu 3 (Art der Bautätigkeit) extension
Bei Baumaßnahmen am bestehenden Gebäude
Ändert sich die Nutzungsart des ganzen Gebäudes? change of use? — ja 1 / nein 2 — 29

Wenn ja, bitte frühere Nutzung angeben if applicable, previous use
Wurde ein Abgangsbogen ausgestellt? — ja 1 / nein 2 — 30

Bei Wiederaufbau, Ersatzbau, Wiederherstellung
in welchem Jahr wurde das Gebäude (Gebäudeteil) abgebrochen, zerstört o. ä.? — 19
Wurde ein Abgangsbogen ausgestellt? — ja 1 / nein 2 — 31

Zu 4 (Größe des Zugangs)
Nachgewiesene Pkw-Stellplätze parking & garaging
(bitte Stellplätze und nach Art und Lage anzugeben)

Art: Garagen		32–35
offene Stellplätze		36–39
Lage: auf dem Baugrundstück		40–43
auf einem getrennten Grundstück		44–47
durch Ablösung bei der Gemeinde		48–51

Für die Richtigkeit und Vollständigkeit:
Der Bauherr: Der Architekt:

....
(Datum und Unterschriften)

Prüfvermerk A 6): ....(Datum und Handzeichen)....................

Bitte zutreffende Ziffer einsetzen!

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

LEVEL 1. CONCISE PHYSICAL DESCRIPTION

1) Name of Scheme ____________
2) Country ___ (* To be indexed)
3) Region ___ (* To be indexed)
4) Location ____________
5) Height Above Sea Level ____ m

6) Name of Architect ____________
7) Construction Period __ __ to __ __ (month/year)

8) Nature of Development :
   - Public scheme Yes/No
   - Private scheme Yes/No
   - Mixed development Yes/No
   - Planned unit development Yes/No
   - Design competition Yes/No

9) No. of Dwellings (by Housing Form) :
   - Detached houses ____
   - Semi-detached houses ____
   - Terraced houses ____
   - Flats ____
   - Maisonettes ____
   - (Thus total number of dwellings is ____)

10) Bedspaces :
   - No. of 1-bedroom dwellings ____
   - No. of 2-bedroom dwellings ____
   - No. of 3-bedroom dwellings ____
   - No. of 4-bedroom dwellings ____
   - No. of 5-bedroom dwellings ____
   - No. of 6-bedroom dwellings ____
   - No. of 7-bedroom dwellings ____
   - No. of 8 or more bedroom dwellings ____
   - (Thus total number of bedspaces is ____)

11) Site Area ____ sq.m.
12) Perimeter Length of Site ____ m

13) Ground Area Covered by Residential Buildings ____ sq.m.
    (% Residential plot coverage __ %)

14) Ground Area Covered by All Buildings ____ sq.m.
    (% Total plot coverage __ %)

15) Total Residential Floor Area ____ sq.m.
    (% Residential plot ratio __ %)

16) Total Building Floor Area ____ sq.m.
    (% Total plot ratio __ %)

17) Car Spaces ____ spaces

18) Housing Layouts :
   - Incorporation of Radburn concept Yes/No
   - Layouts around communal traffic free space Yes/No
   - Layouts around communal parking space Yes/No

19) Building Layouts :

***

DESCRIPTIONS

Building Layouts:

1. Gridiron pattern (or a variation)
2. Linear parallel pattern (or a variation)
3. Repetition of a regular shape pattern
4. Circular pattern (or a variation)
5. Irregular pattern

***

20) Development Costs :

(* Unit cost _______ , Currency ______)

Cost of site acquisition	__________
Construction costs	__________
(Thus total costs of development are	__________)

21) Type of Structural Frame __

***

DESCRIPTIONS

Type of Structural Frame:

1. in-situ conc. reinforced	2. precast conc. reinforced
3. precast conc. pre-stressed	4. timber
5. masonry: blocks	6. masonry: bricks
7. masonry: stones	8. masonry: hybrid
9. reinforced masonry	10. steel
11. hybrid (other than reinforced masonry)	
12. other	

***

22) Predominant Building Materials :

	Material	Form	Finish
Roofs	__	__	__
Wall cladding	__	__	__
Roads	__	__	__
Pavement	__	__	__

***

DESCRIPTIONS

Materials:

0. exposed structure		1. bituminous substances
2. chippings in bituminous substances		3. concrete
4. GRC	5. cast stone	6. calcium silicate
7. clay	8. earth	9. ceramics
10. asbestos	11. cement	12. solid timber
13. chipboards	14. plywood	15. cork
16. natural slate	17. limestone	18. sandstone
19. marble	20. onyx	21. granites
22. quartzite	23. slate	24. other natural stone
25. terrazzo	26. aluminium	27. cast iron
28. wrought iron	29. stainless steel	30. mild steel
31. copper	32. bronze	33. brass
34. zinc	35. lead	36. pvc coated steel
37. plastic	38. GRP	39. linoleum
40. rubber	41. glass	42. gypsum
43. mineral wool	44. wood wool	45. other

Forms:

0. not applicable	1. gravel	2. cobbles
3. setts	4. slab	5. flags
6. brick	7. block	8. tiles
9. flat sheet	10. profiled sheet	11. laminate
12. panel	13. board	14. shingles
15. parquet	16. strip	17. slats
18. in-situ	19. precast	20. felt
21. membrane	22. carpet	23. other

Surface Finishes:

0. naturally faced	1. gypsum based plaster
2. cement based plaster	3. lime based plaster
4. composite plaster	5. stucco
6. resin based coatings	7. decorative papers
8. decorative fabrics	9. wood veneers
10. plastic veneers	11. other

===

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

LEVEL 2. DETAILED PHYSICAL DESCRIPTION

1. PROGRAMME

Group 1. Scheme Identification

```
 Name of Scheme                      ________________________
 Region or Metropolitan City         __
 Regional City or District           ___
 Postal Address                      ________________________
======================================================================
DESCRIPTIONS

Regions and Metropolitan Cities:
 1. Seoul       2. Pusan      3. Taegu      4. Inchon      5. Kwangju
 6. Kyungki     7. Kangwon    8. Chungbuk   9. Chungnam   10. Chunbuk
11. Chunnam    12. Kyungbuk  13. Kyungnam  14. Cheju

Regional Cities and Districts:
  Seoul  01. ~   ~
  Pusan  01. ~   ~   ( abbreviated list )
======================================================================
```

Group 2. Nature of Development

```
 Development Body:
  Is this scheme Public Housing ?                              Yes/No
  Is this scheme Private Housing ?                             Yes/No
  Is this a Housing Association scheme ?                       Yes/No

 Tenancy:
  Is this scheme solely for Owner Occupation ?                 Yes/No
  Is this scheme solely for Rent ?                             Yes/No
  Is this scheme for both Sale and Rent ?                      Yes/No
  Is this Educational or Institutional Accommodation ?         Yes/No

 Special Housing:
  Does this scheme include housing for the Elderly ?           Yes/No
  Does this scheme include housing for Single Persons ?        Yes/No
  Does this scheme include Holiday Homes ?                     Yes/No
  Does this scheme include a Mobile Home Park ?                Yes/No

 Planned Development:
  Is this scheme a Mixed Development ?                         Yes/No
  Is this scheme part of a Planned Unit Development ?          Yes/No
  Is this scheme part of a New Town Development ?              Yes/No

 Refurbishment:
  Is this a Refurbishment scheme ?                             Yes/No

 Special Characteristics:
  Does this scheme involve Courtyard housing ?                 Yes/No
  Does this scheme involve Underground housing ?               Yes/No
  Has the scheme being built to withstand the earth
   tremors ?                                                   Yes/No

 Design Competitions and Awards:
  Has the scheme been selected for a Design Competition ? Yes/No
  Has the scheme been credited with any Design Award ?         Yes/No
```

Group 3. Demography

Age Group	Male	Female	TOTAL
0 - 2	___	___	___
3 - 5	___	___	___
6 - 11	___	___	___
12 - 17	___	___	___
18 - 22	___	___	___
23 - 30	___	___	___
31 - 40	___	___	___
41 - 50	___	___	___
51 - 60	___	___	___
61 - 70	___	___	___
71 and over	___	___	___
TOTAL	___	___	___

Group 4. Project Participants

Client:
- Name of client ______________________
- Name of firm ______________________
- Category _

Architect:
- Name of architect ______________________
- Name of practice ______________________
- Category _

Main Contractor:
- Name of contractor ______________________
- Name of firm ______________________
- Category _

Housing Manager:
- Name of manager ______________________
- Name of firm ______________________
- Category _

DESCRIPTIONS

Category of Client:
1. central government
2. local authority
3. KNHC
4. housing association
5. government nominated builder
6. registered builder
7. private individual
8. other

Category of Architect:
1. private firm: single architect
2. private firm: partnership
3. KNHC's
4. contractor's
5. other

Category of Contractor:
1. private individual
2. registered builder
3. government nominated builder
4. other

Category of Management Organisation:
1. developer's
2. residents' association
3. commercial firm

Group 5. Progress Schedule

Date of Planning/Building Regulations Application	__ __ __ (d/m/y)
Date of Planning/Building Regulations Approval	__ __ __
Date of Tenders Invited	__ __ __
Date of Tenders Received	__ __ __
Date Tender Selected	__ __ __
Start Date of Construction	__ __ __
Completion Date of Construction	__ __ __
Date of Latest Major Alteration and Extension	__ __ __
Date of Demolition	__ __ __

Group 6. Statutory Controls

Planning Controls:

	Before Dev't	After Dev't
Zoning	_	_
District	__	__
Land Use	__	N/A
Special Zoning Area	_	_

Site Controls (before development):

Eminent Domain	Yes/No
Housing Development Promotion	Yes/No
Housing Lots Development Promotion	Yes/No
Land Subdivision (or Rearrangement)	Yes/No

Environmental Protection Controls:

Pollution and Natural Ecology	Yes/No
Noise	Yes/No

DESCRIPTIONS

Zoning:

1. residential: low density
2. residential: medium/high density
3. semi-residential
4. commercial
5. industrial: intensive
6. industrial: moderate
7. semi-industrial
8. natural green field
9. agricultural

District:

1. scenic
2. visual quality: I
3. visual quality: II
4. visual quality: III
5. visual quality: IV
6. visual quality: V
7. building height restriction
8. fire
9. education
10. business
11. port
12. plot coverage enforcement: I
13. plot coverage enforcement: II
14. plot coverage enforcement: III
15. conservation
16. special district enforcement
17. parking
18. airport
19. nature conservation
20. apartments

Land Use:

1. dry field	2. rice paddy field
3. building land	4. saltwork
5. forest	6. orchard
7. livestock farming	8. spa
9. industry	10. road
11. railroad	12. river or stream
13. dike	14. water supply and disposal
15. water treatment	16. park
17. sports arena and playfield	18. recreation
19. education	20. religion
21. historic site	22. cemetery
23. reservoir	24. miscellaneous

Special Zoning Area:

1. building & land use controlled	2. development controlled
3. urbanisation appointed	4. urbanisation withheld

===

2. SITE

Group 1. Site General

Latitude _____ (e.g. 3008N for 30 08'N)
Longitude _____ (e.g. 0940E for 09 40'E)
Height Above Sea Level ____ m

Minimum Depth of Site ____ m
Maximum Width of Site ____ m
Perimeter Length of Site _____ m
Shape of Site _ (regularity) _ (shape)

Particulars of On-site Features Before Development:

Particulars of On-site Features After Development:

Particulars of Adjoining Land:

DESCRIPTIONS

Regularity of Site Boundary:
1. regular 2. irregular

Approx. Shape of Site:

1. triangle	2. rectangular	3. parallelogram	4. trapezium
5. pentagon	6. hexagon	7. U shape	8. S
9. cross	10. T	11. H	12. Y
13. L	14. o	15. Z	16. other

Group 2. Site Ecology

Topography:

	Before Dev't	After Dev't
Surface Drainage Condition	_	_
Liability to Flooding	_	_
Aspect and Degree of Cross-section of the Major Slope	__ To __ At __ Degree (e.g. NW To SE At 12 Degree)	__ To __ At __ Degree

DESCRIPTIONS

Surface Drainage Condition (before development):
1. poor
2. average
3. fair

Liability to Flooding (before development):
1. frequently
2. not very often
3. never

Soil and Geology:

Number of Boreholes Tested on Site __
Subsoil Stability _

Did Depth of Bedrock Cause Problems for Excavation Works ?

Did the Water Table Level Cause Problems for Excavation Works ?

DESCRIPTIONS

Subsoil Stability:
1. poor
2. average
3. fair

Climate:

Number of Degree Days

	Jan	Feb	Mar	Oct	Nov	Dec
No. of Degree Days	__	__	__	__	__	__

Temperature (deg C)

	Jan	Feb	Jun	Jul	Aug	Dec
Monthly Mean	__.__	__.__	__.__	__.__	__.__	__.__
Mean Daily Extreme	__.__	__.__	__.__	__.__	__.__	__.__

Relative Humidity (%)

	Jun	Jul	Aug
Mean Daily Maximum	__	__	__
Mean Daily Minimum	__	__	__

Precipitation (mm)

	Jan	Feb	Jun	Jul	Aug	Dec
Monthly Mean	____	____	____	____	____	____
Extreme Monthly Max.	____	____	____	____	____	____
Extreme Daily Max.	____	____	____	____	____	____

Wind (prevailing)

	Jan	Feb	Jun	Jul	Aug	Dec
Max velocity (Km)	___	___	___	___	___	___
Mean velocity (Km)	___	___	___	___	___	___
Direction (e.g. NWW)	___	___	___	___	___	___

Group 3. Planting (after development)

Number of Evergreen Trees ____
Number of Deciduous Trees ____

Number of Evergreen Shrubs ____
Number of Deciduous Shrubs ____

Area of Ground Cover ____ sq.m.

Area of Grass ____ sq.m.

Provision of Rooftop Planting Yes/No

Group 4. Site Location

Travel Distances from Site to Nearest:	
City centre	__._ Km
Neighbourhood admin. office	__._
Police station	__._
Firehouse	__._
Post office	__._
Nursery school	__._
Primary school	__._
Secondary school	__._
Market place	__._
Pharmacy	__._
Hospital	__._
Bank	__._
Bus stop	__._
Underground station	__._
Motorway	__._
Motorway access	__._

N.B. Specify distance in Km below one decimal point, or enter '0' if located within site.

3. SPATIAL I : EXTERIOR SPACE

Group 1. Number of Separate Blocks According to Building Type and Number of Storeys

Storeys\Type	Det'	Semi-det'	Terr'	Flats	Maison'	Mgt'	Shop'	Ancil'	TOTAL
1	____	____	___	___	___	_	__	_	____
2	____	____	___	___	___	_	__	_	____
3	____	____	___	___	___	_	__	_	____
4		N/A		___	___	_	__	_	____
5		N/A		___	___	_	__	_	____
6		N/A		___	___	_	__	_	____
7		N/A		___	___	_	__	_	____
8		N/A		___	___	_	__	_	____
9		N/A		___	___	_	__	_	____
10		N/A		___	___	_	__	_	____
11		N/A		___	___	N/A	__	_	____
12		N/A		___	___	N/A	__	_	____
13		N/A		___	___	N/A	__	_	____
14		N/A		___	___	N/A	__	_	____
15		N/A		___	___	N/A	__	_	____
16 or over		N/A		___	___	N/A	__	_	____
TOTAL	____	____	___	___	___	_	__	_	____

Group 2. Building and Traffic Layouts

Housing Layouts:

Incorporation of Radburn concept	Yes/No
Layouts around communal traffic free space	Yes/No
Layouts around communal parking space	Yes/No

Building Layouts:

Gridiron pattern (or a variation)	Yes/No
Linear parallel pattern (or a variation)	Yes/No
Repetition of a regular shape pattern	Yes/No
Circular pattern (or a variation)	Yes/No
Irregular pattern	Yes/No

Traffic Segregation:

Pedestrian access shared with cars	Yes/No
Segregation by means of footbridges	Yes/No
Segregation by means of underpasses	Yes/No
Provision of cycle lanes along major roads	Yes/No
Provision of independent cycle tracks away from roads	Yes/No

Type of Garaging:

Individually at ground level within dwelling.	Yes/No
Individually at basement level within dwelling.	Yes/No
Individually at ground level but separate from dwelling.	Yes/No
Communal single storey separate from dwellings.	Yes/No
Garage court incorporated within housing block.	Yes/No
Multi-storey garage separate from dwellings.	Yes/No

Type of On-street Parking:

Individual parking within curtailage	Yes/No
Individual on-street car parking adjacent to dwelling unit	Yes/No
Communal hardstanding	Yes/No

Group 3. Roads, Paths and Parking Provisions

Width of Road and Associated Footway:

	Road	Asso. Footway
Peripheral Access	__ m	__.__ m
Major Access	__	__.__
Intermediate Access	__	__.__
Minor Access	__	__.__

Are Pedestrian Ramps Used Wherever Changes of Level Occur ?	Yes/No
Gradient of Steepest Pedestrian Ramp	__ %

Parking Provision:

Car Spaces	Residential	Shopping	Management	Ancil.	TOTAL
Garaging	____	____	___	___	____
On-street	____	____	___	___	____
TOTAL	____	____	___	___	____

Group 4. Ground Area Distribution

Dwellings:		
Dwellings	______	
Private gardens	_____	
Separate garages	____	
Dwellings total	______	sq.m.
Internal Roads:		
Carriage ways	______	
Parking	____	
Footways and verges	______	
Internal roads total	______	sq.m.
Minor Open Space:		
Planting areas	_____	
Footpaths	____	
Children's playspaces	____	
Minor open space total	_____	sq.m.
Major Open Space:		
Neighbourhood parks	_____	
Major open space total	_____	sq.m.
Sports Grounds:		
Volleyball ground	____	
Tennis courts	____	
Outdoor swimming pool	____	
Gymnasium	____	
Multi-purpose playground	_____	
Sports grounds total	______	sq.m.
Ancillaries:		
NBH admin. office	___	
Police station	___	
Post office	___	
Public bath	___	
Mechanical (power) station	___	
Community centre	___	
Elderly centre	___	
Shopping centre	____	
Miscellaneous shops	____	
Housing management office	___	
Others	____	
Ancillaries total	______	sq.m.
TOTAL Ground Area	______	sq.m.

Group 5. Travel Distances Within Estate

Distances from Dwelling on the Ground Level to:	Minimum	Maximum
Parking or garage	___ m	___ m
Refuse collector	___	___
Main gate	___	___
Nearest gate for vehicle	___	___
Nearest gate for pedestrian	___	___
Children's playspace	___	___
Volleyball ground	___	___
Tennis courts	___	___
Swimming pool	___	___
Gymnasium	___	___
Multi-purpose playground	___	___
Neighbourhood park	___	___
Letter box	___	___
Public phone	___	___
General store	___	___
Shopping centre	___	___
Nursery school	___	___
Primary school	___	___
Secondary school	___	___
Community centre	___	___
Elderly centre	___	___
Pharmacy	___	___
Clinic	___	___
Public bath	___	___
Superintendent's office	___	___
Guard's post	___	___
Housing management office	___	___

4. SPATIAL III : INTERIOR SPACE

Group 1. Units

Number of Units According to Different Housing Forms and Bedspaces:

Form\Bedsp	1	2	3	4	5	6	7	8	9	10 (or more)	TOTAL
Detached	____	____	____	____	____	____	____	____	____	____	____
Semi-det.	____	____	____	____	____	____	____	____	____	____	____
Terraced	____	____	____	____	____	____	____	____	____	____	____
Flat	____	____	____	____	____	____	____	____	____	____	____
Maisonette	____	____	____	____	____	____	____	____	____	____	____
TOTAL	____	____	____	____	____	____	____	____	____	____	____

Enter Details of the Following:

A. Most widely used unit type.
B. Largest unit type or second largest unit type where the largest type coincides with the most widely used type.
C. Smallest unit type or second smallest unit type where the smallest type coincides with the most widely used type.

(Unit: metre)

	A	B	C
Unit Depth (longest)	__._	__._	__._
Unit Width (longest)	__._	__._	__._
Ceiling Height	_._	_._	_._
Floor to Floor Height	_._	_._	_._
Clear Depth of Largest Balcony	_._	_._	_._
Number of Dwelling Units	____	____	____

(Unit of Area: sq.m.)

Function \ Unit Type		A		B		C	
		No.	Area	No.	Area	No.	Area
Living	Living	_	__._	_	__._	_	__._
	Reading	_	__._	_	__._	_	__._
	General purpose	_	__._	_	__._	_	__._
	Dining	_	__._	_	__._	_	__._
	Kitchen	_	__._	_	__._	_	__._
	Kit+Din	_	__._	_	__._	_	__._
	Kit+Din+Liv	_	__._	_	__._	_	__._
	Bedroom	_	__._	_	__._	_	__._
	W.C.	_	__._	_	__._	_	__._
	Bathroom	_	__._	_	__._	_	__._
	Bathroom w/ W.C.	_	__._	_	__._	_	__._
Service	Utility Room	_	__._	_	__._	_	__._
	Laundry Room	_	__._	_	__._	_	__._
	General Storage	_	__._	_	__._	_	__._
	Fuel Storage	_	__._	_	__._	_	__._
	Private Balcony	_	__._	_	__._	_	__._
	Greenhouse	_	__._	_	__._	_	__._
Circulation	Ent. Hall	_	__._	_	__._	_	__._
	Staircase	_	__._	_	__._	_	__._
	Passage	_	__._	_	__._	_	__._
Subtotal		__	___._	__	___._	__	___._
Communal Area		N/A	__._	N/A	__._	N/A	__._
TOTAL Area		N/A	___._	N/A	___._	N/A	___._

Group 2. Blocks

Floor Areas:

(Unit: sq.m.)

	Basement	Upper	Gross	Net(usable)
Detached	______	______	______	______
Semi-detached	______	______	______	______
Terraced	______	______	______	______
Flats	______	______	______	______
Maisonettes	______	______	______	______
Managerial & Admin.	______	______	______	______
Shopping	______	______	______	______
Ancillaries	______	______	______	______
TOTAL	______	______	______	______

Typical Residential Blocks (for the two predominant block types):

	First	Second	
No. of Identical Blocks	__	__	
No. of Different Unit Plans used	___	___	
No. of Dwelling Units	___	___	
Shape of Block Plan	__	__	
No. of Storeys	__	__	
Block Depth	__._	__._	m
Block Length	___._	___._	m
Block Height	__._	__._	m
Type of Internal Access	__	__	
Clear Depth of Communal Corridor	_.__	_.__	m
No. of Lifts	_	_	
Capacity of Lift	___	___	Kg
Floor to Floor Height	_.__	_.__	m
Area of Basement	____.__	____.__	sq.m.
Area of Ground Floor	____.__	____.__	sq.m.
Total Floor Area	_____.__	_____.__	sq.m.
Net Usable Floor Area	_____.__	_____.__	sq.m.

Typical Shopping Blocks (for the largest two blocks):

	Largest	Second Largest	
Shape of Block Plan	__	__	
No.of Storeys	__	__	
Block Depth	__._	__._	m
Block Length	___._	___._	m
Block Height	__._	__._	m
Area of Basement	____.__	____.__	sq.m.
Area of Ground Floor	____.__	____.__	sq.m.
Tot. Floor Area	_____.__	_____.__	sq.m.
Net Usable Floor Area	_____.__	_____.__	sq.m.
No.of Shops	___	___	

DESCRIPTIONS

Internal Access:

1. direct access from GL
2. gallery: every floor
3. corridor: every floor
4. direct-grouped: every floor
5. direct-in-pairs: every floor
6. gallery: every 2nd floor
7. corridor: every 2nd floor
8. gallery: every 3rd floor
9. corridor: every 3rd floor
10. corridor split-level: every 3rd floor
11. other

Block Plan Shape:

1. triangle
2. square
3. rectangular
4. polygon
5. U shape
6. S
7. cross
8. T
9. H
10. Y
11. L
12. o
13. Z
14. square or rectangular with internal courtyard
15. other

5. PHYSICAL

Group 1. Aural

Noise Sources Within Estate and Noise Rating at Dwellings Worst Affected:

Sources	Noise Rating (Leq)
____________________	___ dBA
____________________	___
____________________	___

Is the Estate on an Airline Route ? Yes/No

Orientation and Distance from Airport to the Estate. __ ____
Orientation and Distance from Rail Route to the Estate. __ ____
Orientation and Distance from Motorway to the Estate. __ ____

Noise Sources Outside Estate (other than those stated above) and Noise Rating at Dwelling(s) Worst Affected:

Sources	Orientation from the Ctr.	Distance from the Dwellings	Noise Rating (Leq)
____________________	___ (e.g. WNW)	____ m	___ dBA
____________________	___	____	___
____________________	___	____	___

N.B. The Centre of an estate here, is a point at which the two longest diagonal distances of the estate cross.

Group 2. Olfactory

Sources of Obnoxious Smells and Distance from Dwelling(s) Worst Affected:

Within Estate

Sources	Distance
____________________	___ m
____________________	___
____________________	___

Outside Estate

Sources	Orientation from the Ctr.	Distance
____________________	___	____ m
____________________	___	____
____________________	___	____

N.B. The Centre of an estate here is a point at which the two longest diagonal distances of the estate cross.

Group 3. Visual and Onlooking

Does the Layout allow Sunlight to reach the Living room of a House for a period of at least 2 hours at some time of the Day ?	Yes/No
Usual Spacing between Dwellings or Blocks in Parallel Layouts.	___ m
Distance between Closest Dwellings or Blocks where Living rooms are Facing Each Other.	___ m
Shortest Distance between a Living room and the Closest Pedestrian Path.	__ m
Can Living room be Overlooked Within the Block which is Curved or L shaped ?	Yes/No
Is Visual Privacy, wherever necessary, Protected by Planting, Walling or Any other means ?	Yes/No

6. TECHNICAL I : CONSTRUCTIONAL SYSTEM

Group 1. Constructional Types

Building Structure:

Type of Structural Frame	_
Structural Grid Dimension	
Most Frequently Repeated	__._ m x __._ m
Type of Foundation	_
Type of Floor	_
Type of Roof Structure	_
Form of Roof	_
Roof Angle	__._ degree

DESCRIPTIONS

Type of Structural Frame:

1. in-situ conc. reinforced
2. precast conc. reinforced
3. precast conc. pre-stressed
4. timber
5. masonry: block
6. masonry: brick
7. masonry: stone
8. masonry: hybrid
9. reinforced masonry
10. steel
11. other

Type of Foundation:

1. strip foundation
2. isolated or pad foundation
3. raft : solid slab
4. raft : beam and slab
5 raft : cellular
6. non-piled : composite
7. sheet piling
8. piled : displacement
9. piled : replacement (bored)
10. piled : composite
11. other

Type of Floor:

1. in-situ slab
2. beam and in-situ slab
3. beam and deck
4. joist and deck
5. joist and infill
6. other

Type of Roof Structure:

1. in-situ conc.
2. precast conc.
3. wide span timber
4. wide span steel
5. shell
6. folded plate
7. tension structure
8. other

Form of Roof:

1. flat
2. gable
3. hipped gable
4. hipped
5. mansard
6. quasi-mansard
7. gambrel
8. mono-pitch
9. pyramid
10. other

Building Components:

Windows

	Living	Bedroom	Kitchen	Bath
Type	__	__	__	__
Glazing	_	_	_	_

Doors

	Entrance	Living	Bedroom	Kitchen
Type	_	_	_	_

Form of Private Stairs _
Type of Private Balconies _
Plan Shape of Private Balconies _
Location of Chimney-breast _
Type of Rainwater Gutters _

DESCRIPTIONS

Type of Window:
1. fixed light
2. side hung
3. top hung
4. bottom hung
5. horizontally pivoted
6. vertically pivoted
7. horizontally sliding
8. vertically sliding
9. sliding and folding
10. bottom hung & side hung
11. vertical sliding & bottom hung
12. vertical sliding & side hung
13. awning
14. louvred
15. other

Type of Glazing:
1. single glazing
2. double glazing w/ 3 mm gap
3. double glazing w/ 6 mm gap
4. double glazing w/ 12 mm gap
5. double glazing w/ 20 mm gap or more
6. triple glazing
7. double windows
8. coupled windows

Type of Door:
1. flush 2. glazed 3. louvred 4. panelled

Form of Private Stairs:
1. straight 2. dog-leg 3. open-well 4.spiral

Type of Private Balconies:
0. no balconies
1. individually projected
2. individually recessed
3. projected in a pair
4. recessed in a pair
5. projected gallery
6. recessed gallery
7. corner

Plan Shape of Private Balconies:
1. square or rectangular
2. square or rectangular with corners cut or rounded
3. triangular
4. ovate
5. other

Location of Chimney-breast:
1. projecting from wall 2. flush with wall 3. inside wall

Type of Rainwater Gutters:
1. half round 2. valley 3. box

7. TECHNICAL II : SERVICES AND WELFARE FACILITIES

Group 1. Public Services and Utilities

Water Mains Diameter	__ mmø
Water Tanks	__ ton
Emergency Water Tanks	__ ton
Sewer Diameter	__ mmø
Central Boiler Output (nominal)	__ kW
Central Gas Supply	Yes/No
Mains Electricity	__ KW
Unit Electricity	__ KW
Method of Electricity Distribution	_
No. of Electricity Poles	___
Lawn Sprinkler Provision	Yes/No

DESCRIPTIONS

Method of Electricity Distribution:
1. overhead 2. underground

Group 2. Communication Facilities

Communal TV Aerial	Yes/No
No. of Telephone Connections to Each Unit	_
Unit Broadcasting Facility	Yes/No
Service Call Facility	Yes/No
Central Pigeonhole	Yes/No
Multi-function Console	Yes/No

Group 3. Lifts and hoists

Tot.No.of Lifts for Residential Buildings	___
Tot.No.of Lifts for Shopping Blocks	__
Tot.No.of Lifts for Bldgs Other than Housing and Shopping	__
Provision of Escalators in Non-residential Buildings	Yes/No
Provision of Hoists in Residential Buildings	Yes/No

Group 4. Heating

	Predominant Type	Secondary Type
Heat Source	_	_
Air-conditioning System	_	_
Heat Emitter	_	_
Heat Distribution Method	_	_
Solar System	_	_

Central Boiler Output (nominal)	__ Kw
Unit Boiler Output (nominal)	__ Kw
Communal Solid Fuel Storage	Yes/No
Type of Private Fireplace	_
Provision of Chimney	Yes/No

===

DESCRIPTIONS

Domestic Heating Source:
1.electricity 2.timber 3.solid fuel 4.oil 5.gas

Air-conditioning System:
0. none
1. all-air system: single duct (variable volume)
2. all-air system: single duct (terminal reheat)
3. all-air system: double duct
4. all-water : 4-pipe
5. all-water : 3-pipe
6. all-water : 2-pipe
7. air-water : induction (2-pipe)
8. refrigerant : PTAC (Packaged Terminal Air Conditioner)
9. refrigerant : roof-top
10. other

Heat Emitter Type:
1. floor heating
2. column-type radiators
3. panel-type radiators
4. off-peak storage
5. radiant panels: low temp
6. radiant panels: high temp
7. cabinet-type natural convectors
8. skirting-type natural convectors
9. fan convectors
10. ducted warm air
11. other

Method of Heat Distribution:
1. individual heating
2. central plant room
3. district heating
4. other

Solar Energy System:
0. none
1. direct gain
2. trombe wall
3. water wall
4. roof pond
5. green house
6. thermosiphon
7. hybrid of passive systems
8. active solar
9. hybrid of passive and active systems
10. other

Type of Fireplace:
1. no fireplace
2. gas fired
3. wood fired
4. solid fuel fired
5. false fireplace

===

Group 5. Fire Protection Provisions

Provision of Smoke Detectors	Yes/No
Type of Major Fire Extinguisher provided	_
No. of Fire Extinguishers per Unit	__ per unit
Provision of Hose Reels	Yes/No
Provision of Sprinklers in Each Unit	Yes/No
Provision of Fire-resistant Entrance Doors to Each Unit	Yes/No
Provision of Fire-escape Stairs in Residential Buildings	Yes/No
Provision of Fire-escape Ladder(s) Within Unit	Yes/No
No. of Hydrants on Site	__
Maximum Travel Distance from Unit to Fire-escape Stairs in Multi-family Blocks	__ m

===

DESCRIPTIONS

Type of Fire Extinguisher:
1. water 2. powder 3. gas 4. foam

===

Group 6. Security Provision for Each Unit

Provision of Door Viewer	Yes/No
Provision of Entrance Telephone	Yes/No
Provision of Entrance Video	Yes/No
Provision of Card-key Lock	Yes/No
Provision of Security Grilles/Shutters	Yes/No
Provision of Intruder Detector	Yes/No

Group 7. Refuse Disposal

Maximum Distance from Unit to Refuse Disposal	___ m
Type of Refuse Container Inside Collection Chamber	_
Location of Refuse Chute	_
Size of Hopper	__ x __ cm
Volume of Collection Chamber	___ x ___ x ___ cm
Maximum Distance of Refuse Chamber from Refuse Vehicle	__ m
No.of Dwellings Served by A Refuse Chute	__

==

DESCRIPTIONS

Type of Refuse Disposal:
1. dry carriage: chute and hopper, vacuum
2. manual including dustbins or sacks

Location of Refuse Chute:
1. within unit
2. along communal corridor
3. inside core hall
4. none

==

Group 8. Site Fixtures and Furniture

No. of Play and Recreational Equipment:

balancing beams	__	chain	__
climbing bars	__	climbers	__
ladders: plain	__	ladders: arched	__
climbing net	__	playdome	__
play animals	__	play sculptures	__
rotating equipment	__	merry-go-round	__
rocking boats	__	rocking horses	__
sculptural equipment	__	see-saws	__
slides: plain	__	slides: chute	__
spray pools	__	swings: plane	__
swings: plank	__	wood-climbing blocks	__

other specially designed equipment __

No. of Site Fixtures and Furniture:

advertising, posters	__	barriers	__
benches or seating	__	bollards: barrier	__
bollards: lighting	__	bollards: locking	__
bollards: traffic	__	bicycle stands	__
drinking fountains	__	fences	__
flagpoles	__	fountains	__
gates	__	grit bins	__
guard boxes	__	information offices	__
lighting columns: amenity	__	lighting columns: road	__
letter boxes: wall mounted	__	letter boxes: free-standing	__
litter bins	__	public telephone boxes	__
vending kiosks	__	manholes	__
maps	__	picnic tables & seating	__
planters	__	pools	__
public clocks	__	sculptures	__
signs: bus	__	signs: motor traffic routes	__
signs: pedestrian routes	__	signs: traffic safety	__
street name plates	__	toilets	__
traffic signal controlled crossings	__		
tree grids (square or circular) & guards	__		
graphics & signs (poster stands)	__		

8. TECHNICAL III : BUILDING MATERIALS AND FINISHES

Group 1. Interior (*)

(* See Common Indices For Codes)

			Material	Form	Finish	Paint
	Ceiling	Predominant	___	___	___	_
		Secondary	___	___	___	_
Liv	Part'n Wall	Predominant	___	___	___	_
		Secondary	___	___	___	_
	Floor	Predominant	___	___	___	_
		Secondary	___	___	___	_

			Material	Form	Finish	Paint
	Ceiling	Predominant	___	___	___	_
		Secondary	___	___	___	_
Bed **	Part'n Wall	Predominant	___	___	___	_
		Secondary	___	___	___	_
	Floor	Predominant	___	___	___	_
		Secondary	___	___	___	_

** Typical bedroom

			Material	Form	Finish	Paint
	Ceiling	Predominant	___	___	___	_
		Secondary	___	___	___	_
Kit	Part'n Wall	Predominant	___	___	___	_
		Secondary	___	___	___	_
	Floor	Predominant	___	___	___	_
		Secondary	___	___	___	_

			Material	Form	Finish	Paint
	Ceiling	Predominant	___	___	___	_
		Secondary	___	___	___	_
Bath	Part'n Wall	Predominant	___	___	___	_
		Secondary	___	___	___	_
	Floor	Predominant	___	___	___	_
		Secondary	___	___	___	_

Private Balcony Balustrades	_	(material)
Handrail to Private Staircase	_	(material)
Balustrades to Private Staircase	_	(material)
Handrail to Communal Staircase	_	(material)
Balustrades to Communal Staircase	_	(material)

Window Frames

	Living	Bedroom	Kitchen	Bath
Material	__	__	__	__

Doors

	Entrance	Living	Bedroom	Kitchen
Material	__	__	__	__

Plumbing:

Hot Water Supply Pipes	_	(material)
Cold Water Supply Pipes	_	(material)
Soil Pipes	_	(material)

Group 2. External

	Material	Form	Finish	Paint
External Wall	__	__	__	_
Roof Covering	__	__	__	_
Roof Sarking	__	__	__	_
Rainwater Gutters	__	__	__	_
Rainwater Pipes	__	__	__	_
Drainage Pipes	__	__	__	_
Handrail to Outdoor Staircases	__	__	__	_
Balustrades to Outdoor Staircases	__	__	__	_
Site Boundary Fencing, Railings and Walling	__	__	__	_
Roads	__	__	__	N/A
Paths	__	__	__	N/A
Curbs and Edgings	__	__	__	_

Exposed Concrete Surface Texture	_
Exposed Concrete Surface Treatment	_

DESCRIPTIONS

Exposed Concrete Surface Texture:

1. smooth with pattern
2. smooth w/o pattern
3. fine aggregate with pattern
4. fine aggregate w/o pattern
5. coarse aggregate with pattern
6. coarse aggregate w/o pattern

Exposed Concrete Surface Treatment:

1. brushing and washing
2. tooling
3. sand and shot blasting
4. aggregate transfer
5. grinding and polishing
6. other

Group 3. Site Fixtures and Furniture

Play and Recreational Equipment:

balancing beams	___	chain	___
climbing bars	___	climbers	___
ladders: plain	___	ladders: arched	___
climbing net	___	playdome	___
play animals	___	play sculptures	___
rotating equipment	___	merry-go-round	___
rocking boats	___	rocking horses	___
sculptural equipment	___	see-saws	___
slides: plain	___	slides: chute	___
spray pools	___	swings: plane	___
swings: plank	___	wood-climbing blocks	___
other specially designed equipment	___		

Site Fixtures and Furniture:

advertising, posters	___	barriers	___
benches or seating	___	bollards: barrier	___
bollards: lighting	___	bollards: locking	___
bollards: traffic	___	bicycle stands	___
drinking fountains	___	fences	___
flagpoles	___	fountains	___
gates	___	grit bins	___
guard boxes	___	lighting columns: amenity	___
lighting columns: road	___	letter boxes: wall mounted	___
letter boxes:free-standing	___	litter bins	___
public telephone boxes	___	vending kiosks	___
manholes	___	maps	___
picnic tables & seating	___	planters	___
pools	___	public clocks	___
sculptures	___	signs: bus	___
signs:motor traffic routes	___	signs: pedestrian routes	___
signs: traffic safety	___	street name plates	___
traffic signal controlled crossings	___		
tree grids (square or circular) & guards	___		
graphics & signs (poster stands)	___		

DESCRIPTIONS: COMMON INDICES for MATERIALS and FINISHES

Surface Materials:

0. exposed structure
1. bituminous substances
2. chippings in bituminous substances
3. concrete
4. GRC
5. cast stone
6. calcium silicate
7. clay
8. earth
9. ceramics
10. asbestos
11. cement
12. solid timber
13. chipboards
14. plywood
15. cork
16. natural slate
17. limestone
18. sandstone
19. marble
20. onyx
21. granites
22. quartzite
23. slate
24. other nat'l stone
25. terrazzo
26. aluminium
27. cast iron
28. wrought iron
29. stainless steel
30. mild steel
31. copper
32. bronze
33. brass
34. zinc
35. lead
36. pvc coated steel
37. plastic
38. GRP
39. linoleum
40. rubber
41. glass
42. gypsum
43. mineral wool
44. wood wool
45. other

Forms:

0. not applicable	1. gravel	2. cobbles
3. setts	4. slab	5. flags
6. brick	7. block	8. tiles
9. flat sheet	10. profiled sheet	11. laminate
12. panel	13. board	14. shingles
15. parquet	16. strip	17. slats
18. in-situ	19. precast	20. felt
21. membranes	22. carpet	23. other

Surface Finishes:

0. naturally faced	1. gypsum based plaster
2. cement based plaster	3. lime based plaster
4. composite plaster	5. stucco
6. resin based coatings	7. decorative papers
8. decorative fabrics	9. wood veneers
10. plastic veneers	11. other

Paint:

0. none	1. oil paints	2. emulsion paints
3. metallic paints	4. intumescent paints	5. varnishes
6. other		

==

9. ECONOMIC

Group 1. General

Basis of Tender	_
Type of Tender or Contract	_
Cost Fluctuation	_
No.of Tenders Issued	__
No.of Tenders Received	__
Was Accepted Tender the Lowest	Yes/No

==

DESCRIPTIONS

Basis of Tender:

0. N/A
1. Bill of quantities
2. Bill of approx. quantities
3. Schedule of rates

Type of Tender or Contract:

0. N/A
1. Competitive open
2. Competitive select
3. Negotiated
5. Package deal

Cost Fluctuation:

0. N/A
1. Standard clauses of contract in full
2. Fluctuation clauses for labour only
3. Fluctuation clauses for materials only
4. Firm price

==

Group 2. Sources of Finance

(Cost Unit: Million Won)

	RESIDENTIAL	COMMERCIAL	TOTAL
Client's own	____	____	____
Bank loan	____	____	____
Public housing fund	____	____	____
Housing subsidy	____	____	____
Foreign loan	____	____	____
Other	____	____	____
TOTAL	____	____	____

Group 3. Elemental Costing

(Cost Unit: Hundred Thousand Won)

ELEMENT	RESIDENTIAL	COMMERCIAL	TOTAL
Site			
1.Site acquisition	______	______	______
2.Site work	______	______	______
Subtotal (Site)	______	______	______
Direct Costs			
1.Building			
1] foundations	______	______	______
2] substructure	______	______	______
3] superstructure	______	______	______
4] internal finishes	______	______	______
5] fittings & furnishings	______	______	______
Subtotal (Building)	______	______	______
2.Services			
1] electrical	______	______	______
2] HVAC	______	______	______
3] lifts	______	______	______
4] gas	______	______	______
5] plumbing	______	______	______
6] sanitary appliances	______	______	______
7] fire protection	______	______	______
8] special	______	______	______
Subtotal (Services)	______	______	______
3.Welfare facilities	______	______	______
4.Planting	______	______	______
Subtotal (Direct Costs)	______	______	______
Indirect Costs (Overheads)			
1.Managerial & admin.	______	______	______
2.Sundries	______	______	______
Subtotal (Overheads)	______	______	______
Total Construction Costs	______	______	______
Profit	______	______	______
TAX	______	______	______
TOTAL COSTS	______	______	______

Group 4. Management and Maintenance Costs

(Cost Unit: Hundred Thousand Won)

ELEMENT	RESIDENTIAL	COMMERCIAL	TOTAL
Administration	______	______	______
Cleaning	______	______	______
Refuse disposal	______	______	______
Sanitation	______	______	______
Lift maintenance	______	______	______
Heating & ventilation	______	______	______
Hot water supply	______	______	______
Repair & renewal of fittings, equipment & machinery	______	______	______
Other	______	______	______
TOTAL	______	______	______

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

LEVEL 3. DESIGNER'S INTENTIONS AND CONSTRAINTS

SCHEME ______________________________

ARCHITECT ______________________________

1) What considerations were imposed by the CLIENT ?

2) What considerations were imposed by the NATURAL ENVIRONMENT of SITE ?

3) What considerations were imposed by the SOCIAL ENVIRONMENT of SITE ?

4) What considerations were given to SITE PLANNING ?

5) What considerations were given to BUILDING FORM and APPEARANCE ?

6) What considerations were given to UNIT LAYOUTS ?

7) What considerations were given to CONSTRUCTIONAL METHODS ?

8) What considerations were given to MECHANICAL/ELECTRICAL SYSTEMS ?

9) What considerations were given to BUILDING ECONOMICS ?

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

LEVEL 4. USER SATISFACTION

SCHEME __________________________

==

First enter codes for the nature of users' satisfaction/dissatisfaction listed below (i); then describe more fully (ii).

(i) FUNCTION COMPONENT PHYSICAL SERVICES ERGONOMICS SAFETY EXTENT

__ __ __ __ _ __ _

(ii) DESCRIPTION

==

FUNCTION

Inside Dwelling :

00. N/A
01. dwelling unit as a whole
02. entrance
03. passage ways
04. staircase
05. living
06. dining
07. kitchen
08. day room (general purpose room)
09. bedrooms
10. bathroom
11. utility
12. laundry
13. general storage
14. private balcony
15. greenhouse
16. private garden
17. garage

Outside Dwelling :

21. estate as a whole
22. communal parking/garaging
23. communal stairs/ passage ways
24. carriage ways
25. service vehicle roads
26. footways and verges
27. play equipment
28. schools and day care centres
29. children's playspaces
30. sports grounds and facilities
31. amenity planting areas
32. parks
33. site furniture
34. community centre
35. centre for the elderly
36. shopping centres
37. superintendent's office
38. housing Management office
39. neighbourhood and surroundings
40. other

COMPONENTS

Inside Dwelling :

00. N/A
01. cupboards
02. windows
03. doors
04. walls
05. ceilings
06. floors

Outside Dwelling :

11. external walls	12. roofs
13. pavement	14. planting

PHYSICAL/PHYSIOLOGICAL FACTORS

00. N/A	
01. light	02. temperature
03. noise	04. damp or condensation
05. draughts	06. ventilation
07. smells	08. dirt
09. visual privacy	10. appearance

SERVICES

00. N/A	
01. water supply and disposal	02. gas supply
03. lighting systems	04. HVAC systems
05. mechanical systems	06. conveying systems
07. electrical systems	08. telecommunication systems
09. refuse disposal	10. maintenance of buildings/estate

ERGONOMICS

0. N/A	1. layout
2. access	3. distance
4. size	

SAFETY AND SECURITY

00. N/A	
01. child safety	02. elderly safety
03. disabled safety	04. surveillance
05. trespassers	06. burglaries
07. physical attack	08. fire
09. vandalism	10. structural defects

EXTENT OF SATISFACTION/DISSATISFACTION

1. majority of residents	2. minority of residents

APPENDIX D. FORM OF HOUSING APPRAISAL AND MEASUREMENT

LEVEL 5. PUBLISHED COVERAGE IN PERIODICALS

SCHEME ______________________________

==

Enter code for PERIODICAL from an index (01-11) provided below.
For ASPECT OF HOUSING COVERED, tick wherever appropriate.

PERIODICAL	__	
DATE OF ISSUE	__ __ __ (date/month/year)	
TITLE OF ARTICLE	______________________________	
INCLUSIVE PAGES	from page ____ to page ____	
ASPECT OF HOUSING COVERED		
	1) site context	( )
	2) climate and natural environment	( )
	3) site planning and building layouts	( )
	4) building form and appearance	( )
	5) unit layouts	( )
	6) physical/physiological aspect	( )
	7) economic aspect	( )
	8) building methods and technology	( )
	9) social aspect	( )

==

PERIODICAL

01. Apartment Life	02. Architecture & Culture
03. Architecture & Environment	04. Architecture & Materials
05. Decoration	06. Energy Conservation
07. Environment & Landscape	08. Housing Information
09. KIRA Journal	10. Modern Housing
11. Total Design	(abbreviated list)

APPENDIX E. THE DEMONSTRATION SYSTEM

APPENDIX E. THE DEMONSTRATION SYSTEM

1. THE APPLICATION PROGRAM

```
RUN NAME          FILE DEMO      CODEBOOK DEFINITION
TASK NAME         INITIALIZATION COMMANDS
NEW FILE          DEMO
TASK NAME         CASE DEFINITION
N OF CASES        300
RECS PER CASE     30
MAX INPUT COLS    80
RECTYPE COLS      7
MAX REC TYPES     9
MAX REC COUNT     100
CASE ID           IDNUM
COMMON VARS       IDNUM     (I,6)       /
DOCUMENT   THIS DATABASE CONTAINS LEVEL I DATA ITEMS AND TWO
  PART OF LEVEL II ITEMS OF THE HOUSING INTELLIGENCE SYSTEM.
TASK NAME         RECORD 1 (REC1      )  SCHEMA DEFINITION
RECORD SCHEMA     1  REC1
DOCUMENT   RECORD TYPE 1 CONTAINS CONCISE INFORMATION ON
  LOCATION, CONSTRUCTION PERIOD,
  ARCHITECT AND PARTICULAR NATURE OF
  A HOUSING SCHEME AS WELL AS
  PHYSICAL ATTRIBUTES OF SITE
  INCLUDING AREA DISTRIBUTION
  AND PARKING AND CONSTRUCTION COSTS.  ALSO FLOOR SPACES,
  NUMBER OF DIFFERENT UNIT AND TOTAL DWELLING UNITS
  ARE INCLUDED
SEQUENCE CHECK    OFF
MAX REC COUNT     1
DATA LIST         FIXED (7)
                  /1          IDNUM         1 -    6   (I)
                  /1          NAMESCH       8 -   32   (A)
                  /1          COU          33 -   34   (I)
                  /1          REG          35 -   36   (I)
                  /1          LOC          37 -   61   (A)
                  /2          CONSTA        1 -    8   (A)
                  /2          CONEND        9 -   16   (A)
                  /2          NAMEARCH     17 -   41   (A)
                  /3          MUD           1          (A)
                  /3          PUH           2          (A)
                  /3          PRH           3          (A)
                  /3          HFS           4          (A)
                  /3          HFR           5          (A)
                  /3          HSR           6          (A)
                  /3          HOA           7          (A)
                  /3          ELH           8          (A)
                  /3          SPH           9          (A)
                  /3          RES          10          (A)
                  /3          MHP          11          (A)
                  /3          EIA          12          (A)
                  /3          NTD          13          (A)
                  /3          PUD          14          (A)
                  /3          REH          15          (A)
                  /3          COMPOR       16 -   40   (A)
                  /3          COMPIN       41 -   42   (I)
                  /3          DEAW         43 -   62   (A)
                  /3          DEIN         63 -   64   (I)
                  /4          SHSI          1 -    2   (I)
                  /4          REGU          3          (I)
                  /4          MASL          4 -    5   (I)
                  /4          ORIE          6 -    8   (A)
                  /4          PERI          9 -   12   (I)
                  /4          DWEL         13 -   18   (I)
                  /4          PREX         19 -   24   (I)
                  /4          PUOP         25 -   30   (I)
                  /4          ROAD         31 -   36   (I)
                  /4          ANCI         37 -   42   (I)
                  /4          SITA         43 -   48   (I)
                  /5          EXTPARK       1 -    4   (I)
                  /5          GARPARK       5 -    8   (I)
                  /5          TYGAR         9          (I)
                  /5          TYPARK       10          (I)
                  /6          SICOST        1 -    5   (I)
                  /6          SIWOCO        6 -   10   (I)
                  /6          DICOST       11 -   15   (I)
                  /6          OVCOST       16 -   20   (I)
                  /6          TOCOST       21 -   26   (I)
                  /7          NODIFUN       1          (I)
                  /7          TOTBED        2 -    6   (I)
                  /7          TOTDWEL       7 -   10   (I)
                  /7          RESFLSP      11 -   16   (I)
                  /7          TOTFLSP      17 -   22   (I)
DATE VARS         CONSTA      ('MMIDDIYY')/
                  CONEND      ('MMIDDIYY')/
CAT VARS          MUD         ( 'y'
                                'n'   )/
                  PUH         ( 'y'
                                'n'   )/
                  PRH         ( 'y'
                                'n'   )/
                  HFS         ( 'y'
                                'n'   )/
                  HFR         ( 'y'
                                'n'   )/
                  HSR         ( 'y'
                                'n'   )/
                  HOA         ( 'y'
                                'n'   )/
                  ELH         ( 'y'
                                'n'   )/
                  SPH         ( 'y'
                                'n'   )/
                  RES         ( 'y'
                                'n'   )/
                  MHP         ( 'y'
                                'n'   )/
                  EIA         ( 'y'
                                'n'   )/
                  NTD         ( 'y'
                                'n'   )/
                  PUD         ( 'y'
                                'n'   )/
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                            'n'  )/
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               REG        (1 52)/
               SHSI       (1 16)/
               REGU       (1 2)/
               TYGAR      (0 6)/
               TYPARK     (0 4)/
MISSING VALUES IDNUM      ( BLANK  )/
               NAMESCH    ( BLANK  )/
               COU        ( BLANK  )/
               REG        ( BLANK  )/
               LOC        ( BLANK  )/
               CONSTA     ( BLANK  )/
               CONEND     ( BLANK  )/
               NAMEARCH   ( BLANK  )/
               MUD        ( BLANK  )/
               PUH        ( BLANK  )/
               PRH        ( BLANK  )/
               HFS        ( BLANK  )/
               HFR        ( BLANK  )/
               HSR        ( BLANK  )/
               HOA        ( BLANK  )/
               ELH        ( BLANK  )/
               SPH        ( BLANK  )/
               RES        ( BLANK  )/
               MHP        ( BLANK  )/
               EIA        ( BLANK  )/
               NTD        ( BLANK  )/
               PUD        ( BLANK  )/
               REH        ( BLANK  )/
               COMPOR     ( BLANK  )/
               COMPIN     ( BLANK  )/
               DEAW       ( BLANK  )/
               DEIN       ( BLANK  )/
               SHSI       ( BLANK  )/
               REGU       ( BLANK  )/
               MASL       ( BLANK  )/
               ORIE       ( BLANK  )/
               PERI       ( BLANK  )/
               DWEL       ( BLANK  )/
               PREX       ( BLANK  )/
               PUOP       ( BLANK  )/
               ROAD       ( BLANK  )/
               ANCI       ( BLANK  )/
               SITA       ( BLANK  )/
               EXTPARK    ( BLANK  )/
               GARPARK    ( BLANK  )/
               TYGAR      ( BLANK  )/
               TYPARK     ( BLANK  )/
               SICOST     ( BLANK  )/
               SIWOCO     ( BLANK  )/
               DICOST     ( BLANK  )/
               OVCOST     ( BLANK  )/
               TOCOST     ( BLANK  )/
               NODIFUN    ( BLANK  )/
               TOTBED     ( BLANK  )/
               TOTDWEL    ( BLANK  )/
               RESFLSP    ( BLANK  )/
               TOTFLSP    ( BLANK  )/

VALUE LABELS   COU        (1)'Australia'
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                          (9)'Hong Kong'
                          (10)'Ireland'
                          (11)'Israel'
                          (12)'Italy'
                          (13)'Japan'
                          (14)'Korea'
                          (15)'Luxemburg'
                          (16)'Malaysia'
                          (17)'Netherland'
                          (18)'New Zealand'
                          (19)'Norway'
                          (20)'Portugal'
                          (21)'Taiwan'
                          (22)'Singapore'
                          (23)'Spain'
                          (24)'Sweden'
                          (25)'Swiss'
                          (26)'UK'
                          (27)'USA'
                          (28)'W. Germany' /
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                          (3)'Kangsuh'
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                          (17)'Jung'
                          (18)'S.Inchon city'
                          (19)'E.Inchon city'
                          (20)'N.Inchon city'
                          (21)'Ctr.Inchon city'
                          (22)'Kwachon city'
                          (23)'Kwangmyung city'
                          (24)'Kuri city'
                          (25)'Tongduchon city'
                          (26)'Puchon city'
                          (27)'Sungnam city'
                          (28)'Songtan city'
                          (29)'Suwon city'
                          (30)'Ansan city'
                          (31)'Anyang city'
                          (32)'Euijungpu city'
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            ('n')'No' /
PUH         ('y')'Yes'
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PRH         ('y')'Yes'
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HFS         ('y')'Yes'
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            (5)'pentagon'
            (6)'hexagon'
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            (9)'cross shape'
            (10)'T shape'
            (11)'H shape'
            (12)'Y shape'
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            (2)'irregular' /
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            (1)'ind @ GL wi dwel'
            (2)'ind @ BL wi dwel'
            (3)'ind @ GL sep fr dwel'
            (4)'com GL sep fr dwel'
            (5)'court incor wi hs bl'
            (6)'mult-sto sep fr dwel' /
TYPARK      (0)'none'
            (1)'ind wi curtailage'
            (2)'ind on-str adj dwel'
            (3)'com on-str along dw'
            (4)'com on-str group' /
VAR LABELS  IDNUM      identification number/
            NAMESCH    name of scheme/
            COU        country/
            REG        region/
            LOC        location/
            CONSTA     construction started/
            CONEND     construction ended/
            NAMEARCH   name of architect/
            MUD        mixed-use development/
            PUH        public sector housing/
            PRH        private sector housing/
            HFS        housing for sale/
            HFR        housing for rent/
            HSR        housing for sale and rent/
            HOA        housing association scheme/
            ELH        elderly housing/
            SPH        single-person housing/
            RES        resort or second homes/
            MHP        mobile home park/
            EIA        educational or institutional accommodati;
                       on/
            NTD        new town development/
            PUD        planned unit development/
            REH        rehabilitation scheme/
            COMPOR     competition organised by/
            COMPIN     competition held in/
            DEAW       design award from/
            DEIN       design award in/
            SHSI       shape of site/
            REGU       regularity of site boundary/
            MASL       major slope of site/
            ORIE       orientation of major slope/
            PERI       perimeter length of site in metre/
            DWEL       dwelling area in sq.m/
            PREX       private external space in sq.m/
            PUOP       public open spaces in sq.m/
            ROAD       roads area in sq.m/
            ANCI       ancillary building area in sq.m/
            SITA       total area of site in sq.m/
            EXTPARK    number of external parking in grade/
```

```
                GARPARK      number of parking in garage/
                TYGAR        type of garaging/
                TYPARK       type of external parking/
                SICOST       costs of site acquisition in thou Pounds/
                SIWOCO       costs of site work in thou Pounds/
                DICOST       direct costs in thou Pounds/
                OVCOST       overhead costs in thou Pounds/
                TOCOST       total construction costs in thou Pounds/
                NODIFUN      number of different unit types/
                TOTBED       number of total bedspaces/
                TOTDWEL      number of total dwelling units/
                RESFLSP      residential floor spaces/
                TOTFLSP      total floor spaces/
END SCHEMA
TASK NAME       RECORD 2 (REC2    )  SCHEMA DEFINITION
RECORD SCHEMA   2  REC2
DOCUMENT RECORD TYPE 2 CONTAINS INFORMATION
  ON BUILDING WITH REFERENCE TO FLOOR
  STOREYS AND NUMBER OF SEPARATE BUILDING BLOCKS.
SORT IDS        BLDG (A)        NOSTO (A)
SEQUENCE CHECK  OFF
MAX REC COUNT   400
DATA LIST       FIXED (1)
                /1          IDNUM           1 -    6   (I)
                /1          BLDG            8          (I)
                /1          NOSTO           9 -   10   (I)
                /1          NOSEP          11 -   14   (I)
VAR RANGES      BLDG        (1 6)/
MISSING VALUES  IDNUM       ( BLANK  )/
                BLDG        ( BLANK  )/
                NOSTO       ( BLANK  )/
                NOSEP       ( BLANK  )/
VALUE LABELS    BLDG        (1)'detached houses'
                            (2)'semi-det houses'
                            (3)'terrace houses'
                            (4)'flats'
                            (5)'maisonnettes'
                            (6)'ancillaries' /
VAR LABELS      IDNUM         identification number/
                BLDG          building form/
                NOSTO         number of storeys/
                NOSEP         number of separate building blocks/
END SCHEMA
TASK NAME       RECORD 3 (REC3    )  SCHEMA DEFINITION
RECORD SCHEMA   3  REC3
DOCUMENT RECORD TYPE 3 CONTAINS INFORMATION ON UNIT SIZE
  AND ATTENDANT BEDSPACES AND NUMBER OF DWELLING UNITS.
SORT IDS        BLDG (A)        CATSIZE (A)
SEQUENCE CHECK  OFF
MAX REC COUNT   400
DATA LIST       FIXED (1)
                /1          IDNUM           1 -    6   (I)
                /1          BLDG            8          (I)
                /1          CATSIZE         9          (I)
                /1          UNITSIZE       10 -   12   (I)
                /1          BEDSP          13          (I)
                /1          NODWEL         14 -   17   (I)
VAR RANGES      BLDG        (1 6)/
                CATSIZE     (1 3)/
MISSING VALUES  IDNUM       ( BLANK  )/
                BLDG        ( BLANK  )/
                CATSIZE     ( BLANK  )/
                UNITSIZE    ( BLANK  )/
                BEDSP       ( BLANK  )/
                NODWEL      ( BLANK  )/
VALUE LABELS    BLDG        (1)'detached houses'
                            (2)'semi-det houses'
                            (3)'terrace houses'
                            (4)'flats'
                            (5)'maisonnettes'
                            (6)'ancillaries' /
                CATSIZE     (1)'most freq''tly used'
                            (2)'largest or 2nd lar''t'
                            (3)'smallest or 2nd sm''t' /
VAR LABELS      IDNUM         identification number/
                BLDG          building form/
                CATSIZE       category of unit size/
                UNITSIZE      unit size in sq.m/
                BEDSP         number of bedspaces per unit/
                NODWEL        number of dwelling units/
END SCHEMA
TASK NAME       RECORD 4 (REC4    )  SCHEMA DEFINITION
RECORD SCHEMA   4  REC4
DOCUMENT RECORD TYPE 4 CONTAINS INFORMATION
  ON FORM OF BUILDING BLOCK PLAN,
  STRUCTURAL AND HVAC SYSTEMS.
SORT IDS        BLDG (A)        PRED (A)
SEQUENCE CHECK  OFF
MAX REC COUNT   400
DATA LIST       FIXED (3)
                /1          IDNUM           1 -    6   (I)
                /1          BLDG            8          (I)
                /1          PRED            9          (A)
                /1          TYAC           10 -   11   (I)
                /1          SHPL           12 -   13   (I)
                /1          BALCO          14          (I)
                /2          FOUND           1          (I)
                /2          STRUC           2 -    3   (I)
                /2          FLOOR           4          (I)
                /2          ROOF            5 -    6   (I)
                /3          HEATSO          1          (I)
                /3          HEATDI          2          (I)
                /3          AIRCON          3 -    4   (I)
                /3          HEATEM          5 -    6   (I)
                /3          SOLAR           7 -    8   (I)
CAT VARS        PRED        ( 'p'
                              's'  )/
VAR RANGES      BLDG        (1 6)/
                TYAC        (1 11)/
                SHPL        (1 14)/
                BALCO       (0 7)/
                FOUND       (1 9)/
                STRUC       (1 12)/
                FLOOR       (1 7)/
                ROOF        (1 10)/
                HEATSO      (1 5)/
                HEATDI      (1 4)/
                AIRCON      (0 10)/
                HEATEM      (1 11)/
                SOLAR       (0 10)/
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MISSING VALUES  IDNUM    ( BLANK  )/
                BLDG     ( BLANK  )/
                PRED     ( BLANK  )/
                TYAC     ( BLANK  )/
                SHPL     ( BLANK  )/
                BALCO    ( BLANK  )/
                FOUND    ( BLANK  )/
                STRUC    ( BLANK  )/
                FLOOR    ( BLANK  )/
                ROOF     ( BLANK  )/
                HEATSO   ( BLANK  )/
                HEATDI   ( BLANK  )/
                AIRCON   ( BLANK  )/
                HEATEM   ( BLANK  )/
                SOLAR    ( BLANK  )/
VALUE LABELS    BLDG   . (1)'detached houses'
                         (2)'semi-det houses'
                         (3)'terrace houses'
                         (4)'flats'
                         (5)'maisonnettes'
                         (6)'ancillaries' /
                PRED     ('p')'predominant type'
                         ('s')'secondary type' /
                TYAC     (1)'direct access fr GL'
                         (2)'gallery: every fl'
                         (3)'corridor: every fl'
                         (4)'direct-group:ev fl'
                         (5)'direct-pairs:ev fl'
                         (6)'gallery:ev 2nd fl'
                         (7)'corridor:ev 2nd fl'
                         (8)'gallery:ev 3rd fl'
                         (9)'corridor:ev 3rd fl'
                         (10)'corridor split lev'
                         (11)'other' /
                SHPL     (1)'triangle'
                         (2)'square'
                         (3)'rectangular'
                         (4)'polygon'
                         (5)'U shape'
                         (6)'S shape'
                         (7)'cross shape'
                         (8)'T shape'
                         (9)'H shape'
                         (10)'Y shape'
                         (11)'L shape'
                         (12)'o shape'
                         (13)'Z shape'
                         (14)'other' /
                BALCO    (0)'no balconies'
                         (1)'indiv projected'
                         (2)'indiv recessed'
                         (3)'projected in a pair'
                         (4)'recessed in a pair'
                         (5)'projected gallery'
                         (6)'recessed gallery'
                         (7)'corner' /
                FOUND    (1)'strip'
                         (2)'isolated or pad'
                         (3)'raft: solid slab'
                         (4)'raft: beam & slab'
                         (5)'raft: cellular'
                         (6)'piled: displacement'
                         (7)'piled: replacement'
                         (8)'piled: composite'
                         (9)'other' /
                STRUC    (1)'in-situ rein conc'
                         (2)'precast rein conc'
                         (3)'precast pre-str conc'
                         (4)'timber'
                         (5)'masonry: blocks'
                         (6)'masonry: bricks'
                         (7)'masonry: stones'
                         (8)'masonry: hybrid'
                         (9)'rein masonry'
                         (10)'steel'
                         (11)'hybrid'
                         (12)'other' /
                FLOOR    (1)'in-situ slabs'
                         (2)'beams & blocks'
                         (3)'beams & slabs'
                         (4)'composite decks'
                         (5)'fully prefab'
                         (6)'largely prefab'
                         (7)'other' /
                ROOF     (1)'flat'
                         (2)'gable'
                         (3)'hipped gable'
                         (4)'hipped'
                         (5)'mansard'
                         (6)'quasi-mansard'
                         (7)'gambrel'
                         (8)'mono-pitched'
                         (9)'pyramid'
                         (10)'other' /
                HEATSO   (1)'electricity'
                         (2)'timber'
                         (3)'solid fuel'
                         (4)'oil'
                         (5)'gas' /
                HEATDI   (1)'indiv heating'
                         (2)'central plant'
                         (3)'district heating'
                         (4)'other' /
                AIRCON   (0)'none'
                         (1)'all-air:sing vari'
                         (2)'all-air:sing term'
                         (3)'all-air:double'
                         (4)'all-wat:4 pipe'
                         (5)'all-wat:3 pipe'
                         (6)'all-wat:2 pipe'
                         (7)'air-wat:induction'
                         (8)'packaged terminal'
                         (9)'roof-top'
                         (10)'other' /
                HEATEM   (1)'floor heating'
                         (2)'column radiators'
                         (3)'panel radiators'
                         (4)'off-peak storage'
                         (5)'rad panel:low temp'
                         (6)'rad panel:high temp'
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                (7)'cabinet nat convect'
                (8)'skirting nat convect'
                (9)'fan convectors'
                (10)'ducted warm air'
                (11)'other' /
        SOLAR   (0)'none'
                (1)'direct gain'
                (2)'trombe wall'
                (3)'roof pond'
                (4)'water wall'
                (5)'green house'
                (6)'thermosiphon'
                (7)'hybrid of passive'
                (8)'active solar'
                (9)'hybrid of act & pas'
                (10)'other' /
VAR LABELS      IDNUM    identification number/
                BLDG     building form/
                PRED     predominance in uses/
                TYAC     type of internal access/
                SHPL     shape of block plan/
                BALCO    form of private balconies/
                FOUND    foundation type/
                STRUC    structural type/
                FLOOR    floor type/
                ROOF     roof type/
                HEATSO   domestic heating source/
                HEATDI   method of heat distribution/
                AIRCON   air-conditioning system/
                HEATEM   heat emitter type/
                SOLAR    solar system/
END SCHEMA
TASK NAME       RECORD 5 (REC5    ) SCHEMA DEFINITION
RECORD SCHEMA   5  REC5
DOCUMENT RECORD TYPE 5 CONTAINS INFORMATION ON
  EXTERNAL BUILDING AND PAVING MATERIALS AND FINISHES.
SORT IDS        BLDG (A)      SPOT (A)      DOMI (A)
SEQUENCE CHECK  OFF
MAX REC COUNT   400
DATA LIST       FIXED (1)
                /1       IDNUM        1 -   6   (I)
                /1       BLDG         8         (I)
                /1       SPOT         9         (I)
                /1       DOMI         10        (A)
                /1       MATE         11 -  12  (I)
                /1       FORM         13 -  14  (I)
                /1       FINI         15 -  16  (I)
                /1       PAIN         17        (I)
CAT VARS        DOMI     ( 'p'
                           's'  )/
VAR RANGES      BLDG     (1 6)/
                SPOT     (1 4)/
                MATE     (0 38)/
                FORM     (0 23)/
                FINI     (0 10)/
                PAIN     (0 6)/
MISSING VALUES  IDNUM    ( BLANK  )/
                BLDG     ( BLANK  )/
                SPOT     ( BLANK  )/
                DOMI     ( BLANK  )/
                MATE     ( BLANK  )/
                FORM     ( BLANK  )/
                FINI     ( BLANK  )/
                PAIN     ( BLANK  )/
VALUE LABELS    BLDG     (1)'detached houses'
                         (2)'semi-det houses'
                         (3)'terrace houses'
                         (4)'flats'
                         (5)'maisonnettes'
                         (6)'ancillaries' /
                SPOT     (1)'external wall'
                         (2)'roof'
                         (3)'roads'
                         (4)'footways' /
                DOMI     ('p')'predominant uses'
                         ('s')'secondary uses' /
                MATE     (0)'exposed structure'
                         (1)'bitumin substances'
                         (2)'chipping in bitumin'
                         (3)'conc'
                         (4)'GRC'
                         (5)'cast stone'
                         (6)'calcium silicate'
                         (7)'clay'
                         (8)'earth'
                         (9)'ceramics'
                         (10)'asbestos'
                         (11)'cement'
                         (12)'solid timber'
                         (13)'chipboards'
                         (14)'plywood'
                         (15)'cork'
                         (16)'natural slate'
                         (17)'limestone'
                         (18)'sandstone'
                         (19)'marble'
                         (20)'granites'
                         (21)'terrazzo'
                         (22)'aluminium'
                         (23)'cast iron'
                         (24)'wrought iron'
                         (25)'stainless steel'
                         (26)'mild steel'
                         (27)'copper'
                         (28)'bronze'
                         (29)'brass'
                         (30)'zinc'
                         (31)'lead'
                         (32)'pvc coated steel'
                         (33)'plastic'
                         (34)'linoleum'
                         (35)'rubber'
                         (36)'glass'
                         (37)'glass fibre'
                         (38)'other' /
                FORM     (0)'not applicable'
                         (1)'gravels'
                         (2)'cobbles'
                         (3)'setts'
                         (4)'slabs'
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                  (5)'flags'
                  (6)'bricks'
                  (7)'blocks'
                  (8)'tiles'
                  (9)'flat sheets'
                  (10)'profiled sheets'
                  (11)'panels'
                  (12)'boards'
                  (13)'shingles'
                  (14)'slates'
                  (15)'parquets'
                  (16)'strips'
                  (17)'slats'
                  (18)'in-situ'
                  (19)'precast'
                  (20)'felts'
                  (21)'membranes'
                  (22)'carpet'
                  (23)'other' /
         FINI     (0)'naturally faced'
                  (1)'gypsum based plaster'
                  (2)'cement based plaster'
                  (3)'lime based plaster'
                  (4)'composite plaster'
                  (5)'resin based coatings'
                  (6)'decorative papers'
                  (7)'decorative fabrics'
                  (8)'wood veneer'
                  (9)'plastic veneer'
                  (10)'other' /
         PAIN     (0)'none'
                  (1)'oil paints'
                  (2)'emulsion paints'
                  (3)'enamels'
                  (4)'intumescent paints'
                  (5)'varnishes'
                  (6)'other' /
VAR LABELS       IDNUM    identification number/
                 BLDG     building form/
                 SPOT     spot/
                 DOMI     dominance in uses/
                 MATE     surface or underlaying material/
                 FORM     form or type of material/
                 FINI     finish/
                 PAIN     painting/
END SCHEMA
TASK NAME        RECORD 6 (REC6     ) SCHEMA DEFINITION
RECORD SCHEMA    6  REC6
DOCUMENT RECORD TYPE 6 CONTAINS INFORMATION ON
  PUBLISHED COVERAGE ABOUT SCHEME.
SORT IDS         PERIO (A)     DATEIS (A)
SEQUENCE CHECK   OFF
MAX REC COUNT    400
DATA LIST        FIXED (1)
                 /1       IDNUM        1 -    6    (I)
                 /1       PERIO        8 -    9    (I)
                 /1       DATEIS      10 -   17    (A)
                 /1       INCP        18 -   28    (A)
                 /1       ARTI        29 -   68    (A)
                 /1       CONTEX      69           (A)
                 /1       CLIMAT      70           (A)
                 /1       SIPLNG      71           (A)
                 /1       BLDGFO      72           (A)
                 /1       FUNCTI      73           (A)
                 /1       PHYSIC      74           (A)
                 /1       ECONOM      75           (A)
                 /1       TECHNI      76           (A)
                 /1       SOCIAL      77           (A)
DATE VARS        DATEIS   ('MMIDDIYY')/
CAT VARS         CONTEX   ( 'y'
                            'n'  )/
                 CLIMAT   ( 'y'
                            'n'  )/
                 SIPLNG   ( 'y'
                            'n'  )/
                 BLDGFO   ( 'y'
                            'n'  )/
                 FUNCTI   ( 'y'
                            'n'  )/
                 PHYSIC   ( 'y'
                            'n'  )/
                 ECONOM   ( 'y'
                            'n'  )/
                 TECHNI   ( 'y'
                            'n'  )/
                 SOCIAL   ( 'y'
                            'n'  )/
VAR RANGES       PERIO    (1 60)/
MISSING VALUES   IDNUM    ( BLANK  )/
                 PERIO    ( BLANK  )/
                 DATEIS   ( BLANK  )/
                 INCP     ( BLANK  )/
                 ARTI     ( BLANK  )/
                 CONTEX   ( BLANK  )/
                 CLIMAT   ( BLANK  )/
                 SIPLNG   ( BLANK  )/
                 BLDGFO   ( BLANK  )/
                 FUNCTI   ( BLANK  )/
                 PHYSIC   ( BLANK  )/
                 ECONOM   ( BLANK  )/
                 TECHNI   ( BLANK  )/
                 SOCIAL   ( BLANK  )/
VALUE LABELS     PERIO    (1)'Acier-Stahl-Steel'
                          (2)'Amer J Public Health'
                          (3)'Architects'' J'
                          (4)'Arch''l Asso Q''ly'
                          (5)'Arch''l Design'
                          (6)'Arch''l Digest'
                          (7)'Arch''l Forum'
                          (8)'Arch''l Review'
                          (9)'Architecture'
                          (10)'l''Arch''ure d''aujourd'
                          (11)'Arch''ure Francaise'
                          (12)'Arch''ure Australia'
                          (13)'Arch''ure Plus'
                          (14)'L''architecttura'
                          (15)'Arkitektur, Italy'
                          (16)'Arkitektur, Sweden'
                          (17)'Bauen + Wohnen'
                          (18)'Brick Bulletin'
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                (19)'Br J Soc Medicine'
                (20)'Building Design'
                (21)'Built Env''t'
                (22)'Canadian Architect'
                (23)'Cities'
                (24)'Community Health'
                (25)'Civil Engi''ng,London'
                (26)'Civil Engi''ng,N.Y.'
                (27)'Concrete'
                (28)'Designers'' J'
                (29)'Deutsche Bauzeitung'
                (30)'Ekistics'
                (31)'Env''t & Behavior'
                (32)'Env''t & Planning'
                (33)'Faith & Form'
                (34)'Home Safety Review'
                (35)'House & Home'
                (36)'Housing'
                (37)'Housing & Constru''n'
                (38)'Housing & Plng Rev'
                (39)'Housing Review'
                (40)'Industrialization Fm'
                (41)'Interiors'
                (42)'Int''l Soc Sci J'
                (43)'Japan Architect'
                (44)'J Amer Conc Inst'
                (45)'J Applied Beha''l Sci'
                (46)'J Arch''l Research'
                (47)'J Coll & Univ Stu Hs'
                (48)'Construction Div'
                (49)'Urban Plng Div'
                (50)'KIA J, Korea'
                (51)'Korean Architects'
                (52)'Kumim, Korea'
                (53)'Landscape Arch''ure'
                (54)'Lotus Int''l'
                (55)'Planning'
                (56)'Progr Arch''ure'
                (57)'Architect'
                (58)'Space, Korea'
                (59)'Zodiac'
                (60)'other' /
CONTEX          ('y')'Yes'
                ('n')'No' /
CLIMAT          ('y')'Yes'
                ('n')'No' /
SIPLNG          ('y')'Yes'
                ('n')'No' /
BLDGFO          ('y')'Yes'
                ('n')'No' /
FUNCTI          ('y')'Yes'
                ('n')'No' /
PHYSIC          ('y')'Yes'
                ('n')'No' /
ECONOM          ('y')'Yes'
                ('n')'No' /
TECHNI          ('y')'Yes'
                ('n')'No' /
SOCIAL          ('y')'Yes'
                ('n')'No' /
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VAR LABELS      IDNUM       identification number/
                PERIO       name of periodical/
                DATEIS      date of issue/
                INCP        inclusive pages/
                ARTI        title of article/
                CONTEX      site context/
                CLIMAT      climate/
                SIPLNG      site planning/
                BLDGFO      building form/
                FUNCTI      functional aspect/
                PHYSIC      physical aspect/
                ECONOM      economic aspect/
                TECHNI      technical aspect/
                SOCIAL      social aspect/
END SCHEMA
TASK NAME       RECORD 7 (REC7     ) SCHEMA DEFINITION
RECORD SCHEMA   7  REC7
DOCUMENT RECORD 7 CONTAINS FEEDBACK ON SCHEME.
SORT IDS        ASPECT (A)
SEQUENCE CHECK  OFF
MAX REC COUNT   400
DATA LIST       FIXED (2)
                /1        IDNUM          1 -   6   (I)
                /1        ASPECT         8 -   9   (I)
                /1        DESC1         10 -  80   (A)
                /2        DESC2          1 -  80   (A)
VAR RANGES      ASPECT    (1 10)/
MISSING VALUES  IDNUM     ( BLANK  )/
                ASPECT    ( BLANK  )/
                DESC1     ( BLANK  )/
                DESC2     ( BLANK  )/
VALUE LABELS    ASPECT    (1)'client''s priority'
                          (2)'site context'
                          (3)'climate'
                          (4)'site planning'
                          (5)'building form'
                          (6)'functional'
                          (7)'physical'
                          (8)'economic'
                          (9)'technical'
                          (10)'social' /
VAR LABELS      IDNUM       identification number/
                ASPECT      aspect covered/
                DESC1       description/
                DESC2       description continued/
END SCHEMA
TASK NAME       RECORD 8 (REC8     ) SCHEMA DEFINITION
RECORD SCHEMA   8  REC8
DOCUMENT RECORD TYPE 8 CONTAINS DETAIL INFORMATION ON
  EXTERNAL SPACE PROVISION.
SEQUENCE CHECK  OFF
MAX REC COUNT   1
DATA LIST       FIXED (3)
                /1        IDNUM          1 -   6   (I)
                /1        DWST           8 -  12   (I)
                /1        PRGA          13 -  17   (I)
                /1        GARA          18 -  21   (I)
                /1        APRO          22 -  25   (I)
                /1        CARR          26 -  30   (I)
                /1        CAPA          31 -  34   (I)
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              /1        LARO        35 -   38   (I)
              /1        FOOT        39 -   42   (I)
              /2        AMOP         1 -    5   (I)
              /2        FORE         6 -    9   (I)
              /2        PATH        10 -   13   (I)
              /2        CHPL        14 -   17   (I)
              /2        PARK        18 -   23   (I)
              /2        WALK        24 -   27   (I)
              /2        SPGR        28 -   31   (I)
              /3        SHBU         1 -    4   (I)
              /3        MECH         5 -    7   (I)
              /3        SOAD         8 -   11   (I)
              /3        SPFA        12 -   15   (I)
MISSING VALUES IDNUM    ( BLANK  )/
              DWST      ( BLANK  )/
              PRGA      ( BLANK  )/
              GARA      ( BLANK  )/
              APRO      ( BLANK  )/
              CARR      ( BLANK  )/
              CAPA      ( BLANK  )/
              LARO      ( BLANK  )/
              FOOT      ( BLANK  )/
              AMOP      ( BLANK  )/
              FORE      ( BLANK  )/
              PATH      ( BLANK  )/
              CHPL      ( BLANK  )/
              PARK      ( BLANK  )/
              WALK      ( BLANK  )/
              SPGR      ( BLANK  )/
              SHBU      ( BLANK  )/
              MECH      ( BLANK  )/
              SOAD      ( BLANK  )/
              SPFA      ( BLANK  )/
VAR LABELS    IDNUM       identification number/
              DWST        dwelling structures/
              PRGA        private gardens/
              GARA        garage structures/
              APRO        aprons/
              CARR        carriage ways/
              CAPA        hardstanding parking/
              LARO        road landscaping/
              FOOT        footways & verges/
              AMOP        amenity open spaces/
              FORE        forecourts: not for parking purposes/
              PATH        footpaths/
              CHPL        infants' playspaces/
              PARK        neighbourhood parks/
              WALK        walkways/
              SPGR        sporting grounds/
              SHBU        shopping & business/
              MECH        mechanical plants/
              SOAD        social or admin buildings/
              SPFA        indoor sports facilities/
END SCHEMA
TASK NAME     RECORD 9 (REC9    ) SCHEMA DEFINITION
RECORD SCHEMA  9  REC9
DOCUMENT RECORD TYPE 9 CONTAINS DETAILED LEVEL II
  INFORMATION ON INTERNAL FINISHES AND MATERIALS OF
  A TYPICAL DWELLING TYPE.
SORT IDS      BLDG (A)      FUNC (A)      PART (A)      DOMI (A)

SEQUENCE CHECK OFF
MAX REC COUNT  400
DATA LIST      FIXED (1)
               /1        IDNUM        1 -    6   (I)
               /1        BLDG         8          (I)
               /1        FUNC         9          (I)
               /1        PART        10          (I)
               /1        DOMI        11          (A)
               /1        INTE        12          (I)
               /1        MATE        13 -   14   (I)
               /1        FORM        15 -   16   (I)
               /1        FINI        17 -   18   (I)
               /1        PAIN        19          (I)
CAT VARS       DOMI      ( 'p'
                           's'  )/
VAR RANGES     BLDG      (1 6)/
               FUNC      (1 9)/
               PART      (1 3)/
               INTE      (0 7)/
               MATE      (0 38)/
               FORM      (0 23)/
               FINI      (0 10)/
               PAIN      (0 6)/
MISSING VALUES IDNUM     ( BLANK  )/
               BLDG      ( BLANK  )/
               FUNC      ( BLANK  )/
               PART      ( BLANK  )/
               DOMI      ( BLANK  )/
               INTE      ( BLANK  )/
               MATE      ( BLANK  )/
               FORM      ( BLANK  )/
               FINI      ( BLANK  )/
               PAIN      ( BLANK  )/
VALUE LABELS   BLDG      (1)'detached houses'
                         (2)'semi-det houses'
                         (3)'terrace houses'
                         (4)'flats'
                         (5)'maisonnettes'
                         (6)'ancillaries' /
               FUNC      (1)'foyer'
                         (2)'living room'
                         (3)'bedroom'
                         (4)'kitchen'
                         (5)'dining room'
                         (6)'bathroom'
                         (7)'utility room'
                         (8)'passage hall'
                         (9)'private balcony' /
               PART      (1)'ceiling'
                         (2)'wall'
                         (3)'floor' /
               DOMI      ('p')'predominant uses'
                         ('s')'secondary uses' /
               INTE      (0)'not applicable'
                         (1)'main structure'
                         (2)'suspended ceiling'
                         (3)'nailed to fur-studs'
                         (4)'parti masonry struc'
                         (5)'float cement screed'
                         (6)'susp timber float fl'
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        (7)'other' /
MATE    (0)'exposed structure'
        (1)'bitumin substances'
        (2)'chipping in bitumin'
        (3)'conc'
        (4)'GRC'
        (5)'cast stone'
        (6)'calcium silicate'
        (7)'clay'
        (8)'earth'
        (9)'ceramics'
        (10)'asbestos'
        (11)'cement'
        (12)'solid timber'
        (13)'chipboards'
        (14)'plywood'
        (15)'cork'
        (16)'natural slate'
        (17)'limestone'
        (18)'sandstone'
        (19)'marble'
        (20)'granites'
        (21)'terrazzo'
        (22)'aluminium'
        (23)'cast iron'
        (24)'wrought iron'
        (25)'stainless steel'
        (26)'mild steel'
        (27)'copper'
        (28)'bronze'
        (29)'brass'
        (30)'zinc'
        (31)'lead'
        (32)'pvc coated steel'
        (33)'plastic'
        (34)'linoleum'
        (35)'rubber'
        (36)'glass'
        (37)'glass fibre'
        (38)'other' /
FORM    (0)'not applicable'
        (1)'gravels'
        (2)'cobbles'
        (3)'setts'
        (4)'slabs'
        (5)'flags'
        (6)'bricks'
        (7)'blocks'
        (8)'tiles'
        (9)'flat sheets'
        (10)'profiled sheets'
        (11)'panels'
        (12)'boards'
        (13)'shingles'
        (14)'slates'
        (15)'parquets'
        (16)'strips'
        (17)'slats'
        (18)'in-situ'
        (19)'precast'
        (20)'felts'
        (21)'membranes'
        (22)'carpet'
        (23)'other' /
FINI    (0)'naturally faced'
        (1)'gypsum based plaster'
        (2)'cement based plaster'
        (3)'lime based plaster'
        (4)'composite plaster'
        (5)'resin based coating'
        (6)'decorative papers'
        (7)'decorative fabrics'
        (8)'wood veneer'
        (9)'plastic veneer'
        (10)'other' /
PAIN    (0)'none'
        (1)'oil paints'
        (2)'emulsion paints'
        (3)'enamels'
        (4)'intumescent paints'
        (5)'varnishes'
        (6)'other' /
VAR LABELS     IDNUM   identification number/
               BLDG    building form/
               FUNC    function/
               PART    part/
               DOMI    dominance in uses/
               INTE    intermediate supporting structure/
               MATE    surface or underlaying material/
               FORM    form or type of material/
               FINI    finish/
               PAIN    painting/
END SCHEMA
STRING LENGTH  20
```

SELECT * FROM REC1

IDNUM	NAMESCH	COU	REG	LOC	CONSTA	CONEND	NAMEARCH	MUD	PUH	PRH	HFS	HFR
610001	Halen Estate	25	52	Bern	May 14, 1959	Jul 17, 1961	Atelier 5	y	***	y	y	***
683001	Brittgarden Estate	24	52	Tibro	May 15, 1961	Jun 23, 1968	R.Erskine	***	***	y	y	***
684001	Bonamy Street Scheme	26	52	Southwark, London	Mar 21, 1966	Aug 15, 1968	F.O.Hayes	y	y	***	***	y
695001	Acorn Estate	27	52	Oakland, California	Apr 17, 1965	Jul 09, 1969	Burger & Coplans, In	y	y	***	y	***
700001	Sakuradai Village	13	52	Tokyo	Mar 09, 1969	Nov 17, 1970	Shyozo Uchii & Assoc	***	***	y	***	***
700002	North Peckham	26	52	Southwark, London	May 11, 1967	Nov 30, 1970	F.O.Hayes	y	y	***	***	y
730001	Fullers Slade	26	52	Milton Keynes NT	Mar 30, 1971	Jul 19, 1973	D. Walker	y	y	***	***	y
750001	Walden 7	23	52	Barcelona	Apr 15, 1972	Sep 23, 1975	Taller de Arquitectu	y	***	y	y	***
754001	Camden Estate	26	52	Southwark, London	Mar 30, 1973	Jun 11, 1975	H.P.Trenton	y	y	***	***	y
770001	Dimona	11	52	Dimona Negev	Nov 07, 1975	Dec 14, 1977	M. Buchman	y	y	***	***	y
784080	Yeongdungpo Mido Apt	14	13	H 4-4 Doksandong	Apr 01, 1977	Nov 29, 1978	Samjin Design	y	***	y	y	***
793001	Siheung Terrace Hous	14	13	655-6 Siheungdong	Feb 21, 1979	Oct 17, 1979	Suhyang Architecture	***	***	y	y	***
794060	Orksoo Villa Heights	14	11	220-1 Orksoodong	Jul 07, 1978	Apr 14, 1979	J.J.Engineering	y	***	y	y	***
794070	Daemyung Apt	14	1	H 1-142 Dogokdong	May 24, 1978	Oct 07, 1979	Daeryun Partnership	y	***	y	y	***
804030	Chungdam Taeyang Apt	14	1	19 Chungdamdong	Mar 14, 1979	Sep 21, 1980	Korea Architecture	***	***	y	y	***
804190	Gildong Samik Apt	14	2	H 1-1 Gildong	Mar 12, 1979	Oct 19, 1980	Samik Engineering	y	***	y	y	***
823001	Chungyou Flower Town	14	1	Suhchodong	Oct 21, 1981	Nov 07, 1982	P.Lee Associates	***	***	y	y	***
823002	Garden Residence	14	16	129 Dongsungdong	Sep 30, 1981	Jun 21, 1982	Y.Kim Associates	***	***	y	y	***
824050	Younga Apt	14	4	H 25-6 Sadangdong	Mar 01, 1981	Jun 22, 1982	Sama Architecture	y	***	y	y	***
833010	Hyosung Villa VI	14	1	54-6 Samsungdong	Nov 05, 1982	Oct 10, 1983	Hyosung Engineering	***	***	y	y	***
833222	Hyundai Yuksam Terra	14	1	Yuksamdong	Sep 02, 1982	May 14, 1983	Sanghyup Arch'l Desi	***	***	y	y	***
834150	Apkujung Misung Apt.	14	1	352-1 Apkujungdong	Jun 11, 1982	Oct 29, 1983	Dongbang Architectur	y	***	y	y	***
********************		********	********	********************	************	************	********************	***	***	***	***	***
844001	Pyungtaek Vision Apt	14	50	487 Visionlee	Dec 30, 1983	Sep 29, 1984	Hansung Ltd	y	y	***	y	***
844002	Inchon Suknam Apt II	14	19	445-2 Suknamdong	Dec 30, 1983	Sep 29, 1984	Hansung Ltd	y	y	***	y	***
844003	Inchon Suknam Apt I	14	18	527-2 Suknamdong	Jan 06, 1984	Oct 16, 1984	Hanil Const Co	y	y	***	y	***
844004	Euijungpu Kaneung Ap	14	32	Land Subdiv Bl 97	Oct 19, 1983	Jul 29, 1984	Daenong Group	y	y	***	y	***
844005	Songtan Suhjung Apt	14	28	10-7 Suhjungdong	Jan 05, 1984	Oct 15, 1984	Korea Cons Co	y	y	***	y	***
844006	Yongin Yukbuk Apt	14	47	462 Yonginup Yukbukl	Jul 19, 1983	Apr 28, 1984	Kyungdong Group	y	y	***	y	***
844007	Banwol Kunja Apt	14	40	Banwol New Town Bl 7	Jul 18, 1983	Apr 29, 1984	Kori Dev't	y	y	***	***	***
844008	Suwon Inkae	14	29	357 Inkaedong	Apr 27, 1983	Jun 01, 1984	Dongsan Const	y	y	***	y	***
844009	Songtan Suhjung I	14	28	207-17 Suhjungdong	Oct 22, 1983	Aug 01, 1984	Daesan Const	y	y	***	y	***
844010	Puchon Yakdae	14	26	181 Yakdaedong	Jan 04, 1984	Oct 19, 1984	Hyundae Const	y	y	***	y	***
844011	Inchon Sinhyun	14	20	254 Sinhyundong	Aug 08, 1983	Jun 01, 1984	Jinduk Ind	y	y	***	y	***
844160	Dangsandong Hanil Ap	14	13	92 Dangsandong 4th S	Mar 01, 1983	Apr 30, 1984	********************	y	***	y	y	***
844180	Myungildong Samik Ap	14	2	Myungildong	Oct 01, 1982	Dec 02, 1984	Samik Construction	y	***	y	y	***
850001	Banwon Kunja I	14	30	Banwol Kunja Block 7	Sep 22, 1984	Apr 21, 1985	Hansung Partnership	y	y	***	***	y
850002	Banwol Kunja II	14	30	Banwon Kunja Block 7	Oct 15, 1984	Aug 09, 1985	Kyungdong	y	y	***	y	***
850003	Sangyun	14	25	284 Sangyun	Nov 02, 1984	Aug 13, 1985	Jinsung Ltd.	y	y	***	***	y
850004	Suksoo Scheme I	14	31	Suksoodong Land Devt	Oct 19, 1984	Sep 10, 1985	Lucky Ltd.	y	y	***	***	y
850005	Kwunsun Scheme I	14	29	Kwunsundong Land Adj	May 04, 1984	Apr 24, 1985	Imkwang Const.	y	y	***	y	***
850006	Suksoo Scheme II	14	31	Suksoodong Land Adju	Oct 19, 1984	Apr 21, 1985	Hansung Const.	y	y	***	y	***
850007	Sanbon Apt.	14	40	Sanbon, Kundol	May 14, 1984	Apr 24, 1985	Samik Const.	y	y	***	y	***
850008	Kwunsun Scheme II	14	29	Kwunsundong Land Adj	Dec 22, 1984	Dec 01, 1985	Samik Const.	y	y	***	y	***
850009	Chulsan V-2	14	23	Chulsan Land Dev't A	Oct 20, 1984	Aug 20, 1985	Jinheung Const.	y	y	***	y	***
850010	Chulsan V-1	14	23	Chulsan Land Dev't A	Oct 20, 1984	Aug 20, 1985	Hansin Const.	y	y	***	y	***
850011	Chulsan I	14	23	Chulsan Land Dev't A	Jul 24, 1984	May 24, 1985	Hansung Const.	y	y	***	***	y
850012	Chulsan III	14	23	Chulsan Land Dev't A	Oct 04, 1984	Aug 02, 1985	Hyosung Const.	y	y	***	y	***
850013	Chulsan II	14	23	Chulsan Land Dev't A	Jul 30, 1984	Jun 09, 1985	Korea Dev't Ltd.	y	y	***	y	***
850014	Chulsan II-1	14	23	Chulsan Land Dev't A	Oct 17, 1984	Sep 11, 1985	Imkwang Const.	y	y	***	***	y
850015	Chulsan IV	14	23	Chulsan Land Dev't A	Jul 07, 1984	May 17, 1985	Samwhan Ltd.	y	y	***	y	***
850016	Chulsan I-1	14	23	Chulsan Land Dev't A	Oct 20, 1984	Aug 20, 1985	Hansung Const.	***	y	***	y	***
853001	Yongsan Garrison Res	14	14	Yongsan Garrison	Jul 25, 1984	May 08, 1985	Lucky Dev't	***	y	***	y	***
853233	Hyundai Kwanyang Ter	14	31	H 135-2 Kwanyangdong	Feb 22, 1985	Sep 30, 1985	Daemyung Architectur	***	***	y	y	***

HSR	HOA	ELH	SPH	RES	MHP	EIA	NTD	PUD	REH	COMPOR	COMPIN	DEAW	DEIN	SHS1	REGU
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	2	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	4	2
***	***	***	***	***	***	***	***	y	***	*******************	********	*******************	********	2	2
***	***	***	***	***	***	***	***	y	***	*******************	********	*******************	********	2	1
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***	***	y	***	***	***	***	***	***	***	*******************	********	*******************	********	16	2
***	***	***	***	***	***	***	y	y	***	*******************	********	*******************	********	16	2
***	***	***	***	***	***	***	***	y	***	*******************	********	*******************	********	4	2
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***	***	***	***	***	***	***	***	y	***	*******************	********	*******************	********	1	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	16	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	1	1
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***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	1	2
***	***	***	***	***	***	***	***	***	***	*******************	********	Korea Housing Assoc	83	4	1
***	***	***	***	***	***	***	***	***	***	Kwangmyung Housing	81	*******************	********	4	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	16	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	2	1
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	14	2
***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	4	2
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***	***	***	***	***	***	***	***	***	***	*******************	********	*******************	********	4	1

MASL	ORIE	PERI	DWEL	PREX	PUOP	ROAD	ANCI	SITA	EXTPARK	GARPARK
********	****	700	********	********	********	********	********	27000	19	79
********	****	1100	********	********	********	********	********	********	403	73
0	****	1550	********	********	********	********	********	100000	551	********
********	****	240	********	********	********	********	********	3600	36	********
********	****	********	********	********	********	********	********	1500	********	30
********	****	1615	********	********	********	********	********	180000	0	225
********	****	1920	********	********	********	********	********	248000	********	********
********	****	********	********	********	********	********	********	52000	197	362
0	****	1400	********	********	********	********	********	70000	0	970
********	****	1850	********	********	********	********	********	120000	920	0
********	****	1033	10623	0	27676	20732	660	59691	254	0
********	****	137	198	********	********	********	********	883	2	0
12	SSE	1433	7482	0	32570	14275	916	55243	182	0
0	****	612	3332	********	********	********	360	20695	249	0
0	****	736	4234	********	********	********	86	30616	124	0
********	****	916	6009	********	17734	16475	1027	41245	318	0
********	****	237	1184	1290	548	0	0	3022	12	0
5	SE	399	3139	0	3121	1180	0	7440	27	0
********	****	685	4090	********	********	********	494	25778	89	0
14	SWW	236	868	0	********	********	6	2433	12	0
********	****	456	3031	********	********	********	11	10159	41	0
********	****	746	2768	********	********	********	1493	30367	235	0
********	****	********	********	********	********	********	********	********	********	********
********	****	********	********	********	********	********	********	34538	********	********
********	****	********	********	********	********	********	********	33610	********	********
********	****	********	********	********	********	********	********	35012	********	********
********	****	********	********	********	********	********	********	39637	********	********
********	****	********	********	********	********	********	********	43103	********	********
********	****	********	********	********	********	********	********	20539	********	********
********	****	********	********	********	********	********	********	88800	********	********
********	****	********	********	********	********	********	********	97585	********	********
********	****	********	********	********	********	********	********	33698	********	********
********	****	********	********	********	********	********	********	108219	********	********
********	****	********	********	********	********	********	********	169167	********	********
0	****	343	1204	0	1117	********	135	7443	58	0
********	****	1694	16431	********	67909	39540	2300	126180	980	0
********	****	********	********	********	********	********	********	********	********	********
********	****	********	********	********	********	********	********	8618	********	********
********	****	********	********	********	********	********	********	20149	********	********
********	****	********	********	********	********	********	********	25813	********	********
********	****	********	********	********	********	********	********	58949	********	********
********	****	********	********	********	********	********	********	50577	********	********
********	****	********	********	********	********	********	********	154245	********	********
********	****	********	********	********	********	********	********	74975	********	********
********	****	********	********	********	********	********	********	81038	********	********
********	****	********	********	********	********	********	********	65632	********	********
********	****	********	********	********	********	********	********	39550	********	********
********	****	********	********	********	********	********	********	69150	********	********
********	****	********	********	********	********	********	********	123550	********	********
********	****	********	********	********	********	********	********	36800	********	********
********	****	********	********	********	********	********	********	34500	********	********
********	****	********	********	********	********	********	********	26130	********	********
********	****	********	********	********	********	********	********	135060	********	********
********	****	323	3110	0	********	********	0	10550	39	18

TYGAR	TYPARK	SICOST	SIWOCO	DICOST	OVCOST	TOCOST	NODIFUN	TOCOST	NODIFUN	TOTBED	TOTDWEL	RESFLSP	TOTFLSP
3	4	********	********	********	********	********	3	********	3	250	79	********	********
5	4	********	********	********	********	********	6	********	6	1112	366	********	********
0	4	********	********	********	********	********	6	********	6	2820	918	********	********
********	3	********	********	********	********	********	4	********	4	85	23	********	********
5	********	********	********	********	********	********	1	********	1	80	24	400000	********
6	0	********	********	********	********	********	5	********	5	4595	1390	********	********
3	4	********	********	********	********	********	5	********	5	1190	453	********	********
5	4	********	********	********	********	********	5	********	5	2223	658	********	********
5	0	********	********	********	********	********	4	********	4	2682	882	********	********
0	4	********	********	********	********	********	2	********	2	2800	900	********	********
********	3	2388	0	7296	864	10548	2	10548	2	2570	960	57045	58442
********	3	27	0	88	19	134	1	134	1	24	8	498	498
********	3	3105	210	7366	863	11544	3	11544	3	2352	508	80580	89884
********	4	1449	0	4848	404	6701	2	6701	2	1392	404	38940	41083
********	4	2143	0	5897	242	8282	3	8282	3	1794	403	53981	54551
********	4	1337	21	11904	1637	14899	9	14899	9	2268	744	72988	78196
0	1	200	27	900	80	1207	4	1207	4	60	12	2938	2938
0	3	940	120	1612	253	2925	7	2925	7	135	27	6059	6059
********	3	1540	107	4599	548	6794	2	6794	2	1512	438	52507	54987
********	3	316	82	540	42	980	6	980	6	68	17	2765	2765
********	3	1100	17	1854	120	3091	3	3091	3	270	57	8741	8752
********	4	9110	0	8050	1288	18448	3	18448	3	1162	322	51223	55096
********	********	********	********	********	********	********	********	********	********	********	********	********	********
********	********	0	********	********	********	4420	2	4420	2	1250	410	23207	23647
********	********	0	********	********	********	4884	2	4884	2	1420	400	22874	23375
********	********	0	********	********	********	5546	3	5546	3	1500	420	25057	25565
********	********	0	********	********	********	6864	3	6864	3	1405	480	28636	29309
********	********	0	********	********	********	5741	3	5741	3	1306	450	26847	27513
********	********	0	********	********	********	2668	3	2668	3	760	210	12530	12731
********	********	0	********	********	********	12599	5	12599	5	2480	1080	61568	62888
********	********	0	********	********	********	111960	5	111960	5	2706	830	52028	53178
********	********	0	********	********	********	4616	4	4616	4	1127	382	23200	23669
********	********	0	********	********	********	18033	8	18033	8	3620	1040	70874	72290
********	********	0	********	********	********	23758	7	23758	7	4790	1850	114913	116832
********	3	1490	17	2646	454	4607	1	4607	1	378	126	13353	14317
********	3	22712	1104	43440	3801	71057	5	71057	5	8502	2715	239617	247031
********	********	0	********	********	********	4901	2	4901	2	1440	480	22915	23574
********	********	0	********	********	********	3219	1	3219	1	816	272	14292	14486
********	********	0	********	********	********	3029	2	3029	2	820	300	14931	15229
********	********	0	********	********	********	4933	2	4933	2	970	420	20418	22107
********	********	0	********	********	********	9665	6	9665	6	1971	758	44108	45232
********	********	0	********	********	********	9404	1	9404	1	2460	820	43173	44146
********	********	0	********	********	********	20765	6	20765	6	5012	1728	100024	103113
********	********	0	********	********	********	12743	3	12743	3	2883	930	55483	56143
********	********	0	********	********	********	33071	5	33071	5	5322	1380	138740	141746
********	********	0	********	********	********	25963	4	25963	4	4104	1080	108737	116017
********	********	0	********	********	********	7113	3	7113	3	1160	580	36485	39550
********	********	0	********	********	********	10065	6	10065	6	1738	599	36549	39302
********	********	0	********	********	********	24434	6	24434	6	4304	1484	95209	96510
********	********	0	********	********	********	7260	2	7260	2	1160	580	28161	28919
********	********	0	********	********	********	7006	3	7006	3	1175	470	28040	28444
********	********	0	********	********	********	6152	3	6152	3	1000	500	24055	25497
********	********	0	********	********	********	17852	6	17852	6	1050	300	55120	56282
5	4	1052	0	1800	129	2981	1	2981	1	240	60	8722	8722

SELECT * FROM 2

IDNUM	BLDG	NOSTO	NOSEP
610001	3	3	5
683001	3	3	8
683001	5	4	11
684001	4	4	14
695001	5	3	4
700001	4	5	1
700002	4	5	7
700002	5	4	27
700002	5	5	8
730001	3	2	15
730001	3	3	6
750001	5	16	27
754001	4	5	2
770001	2	2	10
770001	3	4	8
784080	4	5	22
784080	6	2	1
793001	3	2	1
794060	4	11	1
794060	4	12	2
794060	4	13	4
794060	6	3	1
794070	4	12	3
794070	6	3	1
804030	4	13	5
804190	4	12	9
804190	6	3	1
823001	3	2	2
823002	3	2	8
824050	4	12	5
824050	6	3	1
833010	3	3	1
833222	3	3	8
834150	4	14	3
834150	6	3	1
844001	4	5	30
844002	4	5	40
844003	4	5	17
844004	4	5	22
844005	4	5	39
844006	4	5	31
844007	4	5	24
844008	4	5	12
844009	4	5	45
844010	4	5	26
844011	4	5	14
844160	4	10	1
844160	4	11	1
844160	6	3	1
844180	4	12	2
844180	4	15	17
844180	6	2	1
850001	4	5	52
850002	4	5	16
850003	4	5	12
850004	4	5	28
850005	4	5	23
850006	4	5	35
850007	4	5	17
850008	4	5	32
850009	4	5	26
850010	4	5	14
850011	4	5	12
850012	4	5	32
850013	4	5	42
850014	4	5	14
850015	4	5	27
850016	4	5	16
853001	3	3	12
853233	3	3	6

SELECT * FROM 3

IDNUM	BLDG	CATSIZE	UNITSIZE	BEDSP	NODWEL
610001	3	1	189	********	********
610001	3	2	237	********	********
610001	3	3	139	********	********
683001	3	1	71	3	120
683001	3	2	95	4	37
683001	3	3	38	1	26
700001	4	1	51	2	40
700002	4	1	105	4	127
700002	5	1	110	4	459
700002	5	2	127	5	35
700002	5	3	72	2	417
730001	3	1	96	5	263
730001	3	2	108	6	45
730001	3	3	46	2	45
750001	5	1	90	4	315
750001	5	2	120	5	132
750001	5	3	30	1	125
784080	4	1	49	3	650
784080	4	3	44	2	310
793001	3	1	45	3	8
794060	4	1	122	5	193
794060	4	2	174	6	52
794060	4	3	81	3	108
794070	4	1	72	3	224
794070	4	2	82	4	180
804030	4	1	83	4	221
804030	4	2	149	5	52
804030	4	3	125	5	130
804190	4	1	84	3	120
804190	4	2	145	5	60
804190	4	3	43	2	108
823001	3	1	245	5	10
823001	3	2	247	5	1
823001	3	3	244	5	1
823002	3	1	225	5	16
823002	3	2	226	5	4
823002	3	3	223	5	1
824050	4	1	86	3	438
824050	4	2	92	3	66
833010	3	1	139	4	5
833010	3	2	162	4	1
833010	3	3	131	4	5
833222	3	1	148	5	24
833222	3	2	132	5	18
833222	3	3	120	4	15
834150	4	1	92	********	126
834150	4	2	162	********	84
834150	4	3	145	********	112
844001	4	1	59	********	250
844001	4	3	52	********	160
844002	4	1	59	********	280
844002	4	3	52	********	120
844003	4	1	65	********	200
844003	4	2	54	********	190
844003	4	3	47	********	20
844004	4	1	65	********	240

IDNUM	BLDG	CATSIZE	UNITSIZE	BEDSP	NODWEL
844004	4	2	54	********	220
844004	4	3	47	********	20
844005	4	1	65	********	225
844005	4	2	54	********	206
844005	4	3	47	********	19
844006	4	1	65	********	105
844006	4	2	54	********	97
844006	4	3	47	********	8
844007	4	1	66	********	390
844007	4	2	55	********	352
844007	4	3	43	********	200
844008	4	1	65	********	355
844008	4	2	84	********	70
844008	4	3	47	********	35
844009	3	1	73	********	32
844009	3	2	62	********	16
844009	3	3	59	********	24
844009	4	1	59	********	310
844010	3	1	73	********	40
844010	3	2	62	********	20
844010	3	3	59	********	30
844010	4	1	84	********	190
844010	4	2	75	********	180
844010	4	3	47	********	6
844011	4	1	66	********	430
844011	4	2	84	********	120
844011	4	3	43	********	150
844160	4	1	93	3	126
844180	4	1	43	2	585
844180	4	2	112	4	180
844180	4	3	63	3	390
853001	3	1	178	********	102
853001	3	2	191	********	72
853001	3	3	150	********	42
853233	3	1	131	********	60

SELECT * FROM REC4

IDNUM	BLDG	PRED	TYAC	SHPL	BALCO	FOUND	STRUC	FLOOR	ROOF	HEATSO	HEATDI	AIRCON	HEATEM	SOLAR
610001	3	p	1	3	2	********	********	********	1	********	********	********	********	********
683001	3	p	2	11	1	********	********	********	1	********	********	********	********	********
684001	4	p	4	6	5	********	********	********	1	********	********	********	********	********
695001	5	p	1	4	1	********	********	********	1	********	********	********	********	********
700001	4	p	5	4	1	********	********	********	1	********	********	********	********	********
700002	5	p	8	2	0	********	9	********	10	********	********	********	********	********
730001	3	p	1	3	0	********	********	********	8	********	********	********	********	********
750001	5	p	8	2	1	********	1	********	1	********	********	********	********	********
754001	4	p	2	14	1	********	********	********	1	********	********	********	********	********
770001	2	p	1	2	0	********	********	********	1	********	********	********	********	********
770001	3	p	5	6	2	********	********	********	1	********	********	********	********	********
784080	4	p	5	3	4	********	1	********	1	4	********	********	********	********
793001	3	p	5	13	2	********	6	********	2	4	2	6	3	0
794060	4	p	2	3	4	********	1	1	1	4	2	6	5	0
794060	4	s	5	11	2	4	********	********	1	********	********	********	********	********
794070	4	p	2	13	6	********	1	********	2	********	********	********	********	********
804030	4	p	2	11	6	********	1	********	1	********	********	********	********	********
804030	4	s	5	3	4	********	********	********	********	********	********	********	********	********
804190	4	p	2	3	4	********	1	********	6	4	2	********	********	********
804190	4	s	5	5	7	********	********	********	********	********	********	********	********	********
823001	3	p	1	3	3	1	2	6	2	4	2	9	1	0
823002	3	p	1	8	7	1	9	1	2	4	1	8	4	0
824050	4	p	2	11	6	3	1	3	6	4	2	6	3	0
824050	4	s	********	2	********	********	********	********	********	********	********	********	********	********
833010	3	p	5	3	1	********	1	6	2	1	1	0	3	0
833222	3	p	5	.3	7	********	9	********	2	4	2	5	3	0
834150	4	p	5	3	2	********	********	********	1	********	********	********	********	********
834150	4	s	2	********	********	********	********	********	********	********	********	********	********	********
834150	6	p	********	3	********	********	********	********	********	********	********	********	********	********
844001	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844002	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844003	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844004	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844005	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844006	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844007	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844008	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844008	4	s	********	********	********	********	********	********	********	4	********	********	********	********
844009	3	p	********	********	********	********	********	********	********	3	********	********	********	********
844009	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844010	3	p	********	********	********	********	********	********	********	3	********	********	********	********
844010	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844010	4	s	********	********	********	********	********	********	********	4	********	********	********	********
844011	4	p	5	********	********	********	********	********	********	3	********	********	********	********
844011	4	s	********	********	********	********	********	********	********	4	********	********	********	********
844160	4	p	5	3	4	********	1	********	6	********	********	********	********	********
844180	4	p	5	3	4	********	1	********	********	********	********	********	********	********
844180	4	s	2	11	********	********	********	********	********	********	********	********	********	********
850001	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850002	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850003	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850004	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850006	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850007	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850008	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850009	4	p	5	********	********	********	********	********	********	********	********	********	********	********

IDNUM	BLDG	PRED	TYAC	SHPL	BALCO	FOUND	STRUC	FLOOR	ROOF	HEATSO	HEATDI	AIRCON	HEATEM	SOLAR
850010	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850011	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850012	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850013	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850014	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850015	4	p	5	********	********	********	********	********	********	********	********	********	********	********
850016	4	p	5	********	********	********	********	********	********	********	********	********	********	********
853001	3	p	5	********	********	********	********	********	********	4	********	********	********	********
853001	4	p	********	********	********	********	********	********	********	********	********	********	********	********
853233	3	p	5	3	2	********	6	1	2	4	2	5	5	0

SELECT * FROM REC5

IDNUM	BLDG	SPOT	DOMI	MATE	FORM	FINI	PAIN
610001	3	1	p	3	18	0	2
695001	5	1	p	12	12	1	0
700001	4	1	p	3	18	0	2
700002	5	1	p	7	6	0	0
730001	3	1	p	12	12	0	1
750001	5	1	p	3	18	10	2
770001	2	1	p	20	7	0	0
770001	3	1	p	20	7	0	0
784080	4	1	p	0	0	2	2
784080	4	2	p	1	18	4	0
793001	3	1	p	9	8	********	********
793001	3	2	p	7	8	********	********
794060	4	1	p	0	0	0	2
794060	4	3	p	1	0	0	0
794060	4	4	p	3	4	0	0
794060	6	1	p	9	8	0	0
794070	4	1	p	0	0	2	2
804030	4	1	p	0	0	2	2
804030	4	2	p	1	0	4	0
804190	4	1	p	0	0	2	2
823001	3	1	p	20	7	0	0
823001	3	2	p	9	8	0	0
823001	3	3	p	1	18	0	0
823001	3	4	p	20	6	0	0
823002	3	1	p	9	8	5	0
823002	3	2	p	16	13	0	0
823002	3	3	p	3	18	0	0
823002	3	4	p	3	18	0	0
824050	4	1	p	0	0	0	2
833010	3	1	p	9	8	********	********
833010	3	2	p	9	8	********	********
833222	3	1	p	20	7	0	0
833222	3	2	p	9	8	0	0
834150	4	1	p	0	0	2	2
834150	4	2	p	2	18	********	********
834150	6	1	p	0	0	5	0
853233	3	1	p	20	7	0	0
853233	3	2	p	9	8	0	0

SELECT * FROM REC6

IDNUM	PERIO	DATEIS	INCP	ARTI	CONTEX	CLIMAT	SIPLNG	BLDGFO	FUNCTI	PHYSIC	ECONOM	TECHNI	SOCIAL
610001	5	Feb 15, 1963	***********	**	******	******	******	******	******	******	******	******	******
683001	4	Oct 10, 1969	27-32	Energy Conscious Design	******	y	******	******	******	******	******	******	******
683001	16	May 22, 1966	1231-1249	Environmental design project examples	******	y	******	******	******	******	******	******	******
684001	3	Sep 03, 1969	***********	To be included here.	******	******	******	******	******	******	******	******	******
684001	5	Sep 21, 1967	***********	To be included here.	******	******	******	******	******	******	******	******	******
684001	8	Nov 15, 1967	***********	To be included here.	******	******	******	******	******	******	******	******	******
684001	17	Feb 20, 1969	***********	To be included here.	******	******	******	******	******	******	******	******	******
700001	43	Oct 21, 1971	36-43	**	******	******	y	y	******	y	******	******	******
700002	5	Sep 21, 1967	23-32	**	******	******	******	******	******	******	******	******	******
700002	8	Jan 17, 1966	121-132	North Peckham Development	******	******	******	******	******	******	******	******	******
700002	8	Nov 17, 1967	82-88	**	******	******	******	******	******	******	******	******	******
700002	17	Dec 20, 1968	39-40	**	******	******	******	******	******	******	******	******	******
730001	3	Oct 09, 1975	***********	**	******	******	******	******	******	******	******	******	******
730001	5	Jun 15, 1973	***********	**	******	******	******	******	******	******	******	******	******
730001	5	Aug 15, 1974	***********	**	******	******	******	******	******	******	******	******	******
730001	5	Dec 15, 1975	763-772	Newcomers to Milton Keynes	******	******	y	y	y	******	******	******	******
750001	4	Oct 10, 1975	***********	**	******	******	******	******	******	******	******	******	******
750001	5	Jul 21, 1975	402-414	Bofill	******	******	******	y	******	******	******	y	******
754001	3	Sep 05, 1973	***********	To be included.	******	******	******	******	******	******	******	******	******
793001	51	May 13, 1980	***********	**	******	******	******	******	******	******	******	******	******
794060	36	Dec 15, 1980	p75 to p79	Bldg Foundations & Cost Implication	******	******	******	******	******	******	y	y	******
823001	51	Oct 11, 1983	71-73	Ideal Home	******	******	******	y	******	******	******	******	******
823002	52	Sep 16, 1982	17-22	Status quo of terraced housing	******	******	y	y	******	******	******	******	******
823002	58	Jan 12, 1983	1211-1220	Competition biased	******	******	******	******	******	******	******	******	y

SELECT * FROM REC7

IDNUM	ASPECT	DESC1	DESC2
610001	2	4.5 Km to the N of the ctr of Bern in a forest clearing which slopes	down to the S (16%); surrounded by fields & 80 m lower to S is a dammed river
610001	4	E-W footpaths are marked by a genuine pergola as an access area: the	lower path has a ctr village sq, & upper footpath has a recreation area.
683001	2	Suburb on the edge of the town, 3/4 km SE of the ctr of the small town	of Tibro (pop 8000). Erskine produced an expansion plan for this town.
683001	4	Access & parking are sited around the periphery & are shared by the	single & multi-fam units. Max dist btw car & dwell is 100-120 m.
684001	2	Located to the S of the Thames & is w/i	an area of railway connections &industrian polants.
684001	4	Parking provided along the roads beneath the	residential bldgs. Access is from the E & the W.
695001	2	Acorn is in the West of Oakland, and is part of a largert renovation	& reconstruction district of what were formally old, tightly packed houses.
695001	4	In accord w/ the bldg structure, vehicle courtyards of varying depths	lead from the access roads to the plots; all dwels have direct vehic access.
700002	2	Ctr section of a larger redev't area of about 45 ha w/ a pop 12000.	The district is to the S of the Thames & is the Surrey Canal btw Old K & Peck
700002	4	External access to the residential district w/ direct entry to 5 3-	storeyed collective garages, beneath the pedestrian level.
730001	2	N of the NT of Milton K., near Stoney Stratford & btw the old & the	new A5 in the N. The site slopes slightly from S to N (9M).
730001	4	Linked to the E & W w/ the chess board street layout of Milton K.	Access to the rows of houses is provided by cul de sacs running from NS steet
750001	2	7 Km to the S of the ctr of Barcelona, is near the first exit on the	Barcelona Tarragona motorway, & is within an industrial surburb.
750001	4	Streets surround the plot on all sides, access from the S, parking in	a basement level, and in street spaces.
754001	2	Located btw the Rye Lane Ctr & the planned N Camberwell	park; in the N the residential district connects w/ N Peckham.
754001	4	Access is provided at GL FL lev from Commercial way, which	is to form an outer ring road around the district as far as Losford st.
770001	1	A planned extension of the new town of Dimona Negev, & is to house	mainly immigrants from various countries. The site slopes down to the NW (4%)
770001	4	Cul de sacs (mx 100m) lead from the outer access roads to the parking	courtyards. Max distance btw car & dwelling is 30 M.
793001	1	Wanted to go for individual heating.	**
794060	10	A block for foreigners. Social activities between foreign &	demestic residents rare. Bldg layouts partly responsible.
794070	5	Two building blocks of 12 storeys	incorporate 5 storey wings.
823001	9	Incorporated Austrian RASTRA walling	technique.
823002	1	Client as speculative company wanted	luxurious interiors
823002	6	Individual sauna & fire place have been	installed.
834150	5	The use of primary colours on external wall was criticised for	being impairing the natural beauty of the nearby Han River.
834150	8	City gas main is connected for cooking purposes.	**
844180	2	A site for primary school is within the site	**

SELECT * FROM REC8

IDNUM	DWST	PRGA	GARA	APRO	CARR	CAPA	LARO	FOOT	AMOP	FORE	PATH	CHPL	PARK	WALK	SPGR	SHBU	MECH	SOAD	SPFA
784080	10623	********	********	********	********	********	********	********	********	0	********	********	********	********	********	660	********	********	********
793001	198	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********
794060	7482	0	0	0	9645	2730	0	1900	25600	0	6000	950	0	0	0	0	0	0	0
794070	3332	********	********	********	********	********	********	********	********	********	********	********	********	********	********	360	********	********	********
804030	4234	0	0	0	********	********	********	********	********	********	********	********	********	********	********	********	571	********	********
804190	6009	********	********	********	11705	4770	********	********	********	********	********	1237	********	********	********	859	5	163	********
824050	4090	********	********	********	********	********	********	********	********	********	********	680	********	********	********	494	********	********	********
833010	868	********	********	********	********	********	********	********	********	********	********	50	********	********	********	********	********	6	********
833222	3031	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	********	11	********
834150	2768	********	********	********	********	********	********	********	********	********	********	********	********	********	********	1493	********	********	********
844180	16431	********	********	********	********	********	********	********	********	********	********	2826	********	********	********	1788	41	471	1800

SELECT * FROM REC9

IDNUM	BLDG	FUNC	PART	DOMI	INTE	MATE	FORM	FINI	PAIN
784080	4	2	1	p	1	0	0	6	0
784080	4	2	2	p	4	11	18	6	0
784080	4	2	3	p	5	34	22	0	0
784080	4	3	1	p	1	0	0	6	0
784080	4	3	2	p	4	11	18	6	0
784080	4	3	3	p	1	11	18	6	5
784080	4	6	1	p	2	10	12	0	2
784080	4	6	2	p	4	9	8	0	0
784080	4	6	3	p	1	9	8	0	0
793001	3	2	1	p	2	38	8	0	0
793001	3	3	3	p	6	11	18	6	5
794060	4	2	1	p	2	14	9	7	0
794060	4	2	2	p	4	12	11	0	5
794060	4	2	3	p	5	12	16	0	2
794070	4	2	1	p	2	38	12	6	0
794070	4	2	2	p	3	12	16	0	5
794070	4	2	3	p	6	12	7	0	5
804030	4	1	1	p	3	38	12	6	0
804030	4	1	2	p	4	11	18	6	0
804030	4	1	3	p	5	9	8	0	0
804030	4	2	1	p	3	38	12	6	0
804030	4	2	2	p	4	11	18	6	0
804030	4	2	3	p	3	12	7	0	5
804030	4	3	1	p	3	38	12	6	0
804030	4	3	2	p	4	11	18	6	0
804030	4	3	3	p	5	11	18	6	5
804030	4	4	1	p	3	38	12	6	0
804030	4	4	2	p	5	9	8	0	0
804030	4	4	3	p	3	12	7	0	5
804030	4	5	1	p	3	38	12	6	0
804030	4	5	2	p	4	11	18	6	0
804030	4	5	3	p	3	12	7	0	5
804030	4	6	1	p	3	38	12	0	3
804030	4	6	2	p	4	9	8	0	0
804030	4	6	3	p	5	9	8	0	0
804030	4	7	1	p	3	38	12	0	2
804030	4	7	2	p	4	9	8	0	0
804030	4	7	3	p	5	9	8	0	0
804030	4	9	1	p	1	0	0	2	2
804030	4	9	2	p	1	0	0	2	2
804030	4	9	3	p	5	9	8	0	0

APPENDIX E. THE DEMONSTRATION SYSTEM

3. THE MENU-DRIVEN SYSTEM AND SUBROUTINES WITH THEIR INFORMATION OUTPUT

```
PROCEDURE       MENU.CRITERIA:T
*
*     ** YOUR Current Selection Criteria are :
*     Dwellings between <*> and <*>
*     Site Areas between <*> and <*>
*     Construction Costs between <*> and <*>
*     Region <*> , Country <*> , Type <*>
*
END PROCEDURE
PROCEDURE       MENU.DET1:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det1(<idnum>)
ex menu.DETPRINT
END PROCEDURE
PROCEDURE       MENU.DET10:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det10(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET11:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det11(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET2:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det2(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET3:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det3(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET4:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det4(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET5:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det5(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET6:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det6(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET7:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
```

```
* ** Retrieval is being performed. **
run ret.det7(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET8:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det8(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DET9:T
ex menu.criteria
*   ** The Schemes of Your Interest are :
*
type tempfile
*
set demand idnum 'Enter Identification Number of Your Interest '
*
* ** Retrieval is being performed. **
run ret.det9(<idnum>)
ex menu.detprint
END PROCEDURE
PROCEDURE       MENU.DETE:T
*
*
*
*
*
*
*     Bye,
*
*     See  You  Again  !
*
*
*
*
*
*
END PROCEDURE
PROCEDURE       MENU.DETN:T
*
ex menu.main
END PROCEDURE
PROCEDURE       MENU.DETPRINT:T
*
*
*
*
*        ** PRINT OPTION **
*
*
*   If you wish to have a print-out of
*   the result of  the previous query,
*   type  '0'.   Otherwise, type  '1'.
```

```
*
*
*
set demand option 'Enter Option '
ex menu.prog<option>
END PROCEDURE
PROCEDURE       MENU.DETS:T
*
ex menu.select
*
*
END PROCEDURE
PROCEDURE       MENU.MAIN:T
*
* **   **   **   **   **   **   **   **   **   **   **   **
*
*      Welcome to Housing Intelligence Service  !
*
*     PLEASE press RETURNs to activate the SYSTEM.
*
*
*
set demand tol '     H
set demand tou '      O
set demand sil '       U
set demand siu '        S
set demand lco '          I
set demand uco '           N
set demand co '            G
set demand rg '                 Intelligence  Service !
*
*
*
*                ** SCHEME  SELECTION **
*
*
*    You will be  prompted  for the characteristics of the
*    schemes you wish to investigate. The following values
*    will be  requested : Upper and Lower limits on NUMBER
*    of DWELLINGS, SITE AREA, CONSTRUCTION COSTS, LOCATION
*    and the  FORM  of  HOUSING.
*
*    ( HOWEVER, you may SKIP characteristics of no interest
*     to you. )
*
*    A search for relevant schemes will be made using these
*    limits.  Further information subsequently be requested.
*    ( The  system  uses  sq.m. for  SITE AREA.  1 acre  is
*     approximately  0.4  hectares or  4,000  sq.m. )
*
*    For the NUMBER of DWELLINGS, SITE AREA and CONSTRUCTION
*    COSTS, you are required to enter a range of values that
*    include  your  particular requirements.  Supposing, you
*    require approx. 400 dwellings,  you could enter 380 for
*    lower limit  and  420 for upper limit.
*
*    The housing form you have chosen will be the predominant
*    form,  thus  it  may  or  may not involve other forms of
*    housing.
*
set demand bdg 'Press RETURN to continue'
```

```
*
*
*            ** HELP  Screen  **
*
*   Codes for COUNTRIES are :
*
*    1. Australia   -           -          11. ISRAEL
*   13. JAPAN      14. KOREA   23. SPAIN   24. SWEDEN
*   25. SWISS      26. UK      27. USA      -
*
*   Codes for REGIONS are :
*
*    1. KANGNAM    2. KANGDONG    4. KWANAK   11. SUNGDONG
*   13. YEONG'PO  14. YONGSAN    16. CHONGRO  18. S.INCHON
*   19. E.INCHON  20. N.INCHON   23. KWANG'NG 25. TONGDU'
*   26. PUCHON    28. SONGTAN    29. SUWON    30. ANSAN
*   31. ANYANG    32. EUIJ'PU    40. SIHEUNG  47. YONGIN
*
*   Codes for Form of Housing :
*
*   1. Detached houses  2. Semi-detached    3. Terraced
*   4. Flats              5. Maisonettes
run ret.retprog(<tol>,<tou>,<sil>,<siu>,<lco>,<uco>,<co>,<rg>,<bdg>)
ex menu.select
END PROCEDURE
PROCEDURE      MENU.PLAN:T
*
*
*
*
*   **   PLANS   **
*
*
*   Sorry, please see the terminal
*   right next to this.
*
*
*
*
*
ex menu.select
END PROCEDURE
PROCEDURE      MENU.PROG0:T
*
*
*
*
*
*
*
*
*
*
*
*   Sorry, print facility is
*   not available.
*
*
*
*
*
*
*
ex menu.progl
*
END PROCEDURE
PROCEDURE      MENU.PROG1:T
*
*             **   DETAIL  SELECTION  **
*
*  1. Location, construction period, architect, competition
*     & design awards  history  & various nature of scheme.
*  2. Physical description of  Site.
*  3. Block  particulars , including  garaging and  parking
*    provisions.
*  4. Dwelling  Unit  particulars.
*  5. Construction  Particulars , including  structural and
*    H V A C  types  &  external  materials  and  finishes.
*  6. Concise  Construction  Costs  particulars.
*  7. Published  Coverage  on  scheme.
*  8. Feedback from Project Architect or Editor.
*  9. Density   Figures   of   Scheme.
*
* 10. External   Space   Provision  detail.
* 11. Internal Materials & Finishes detail.
*
* -----------------------------------------------------------------
* Or
*  IF You wish to go back to Selection Mode, please type 's'.
*  IF You wish to start New Search, please type 'n'.
*  IF You wish to end the session, please type 'e'.
*
set demand option 'Enter option'
ex menu.det<option>
END PROCEDURE
PROCEDURE      MENU.PROG2:T
*
type tempfile
*
*  **  PLAN  SELECTION  **
*
*  1. Site Context
*  2. Site Plan
*  3. Block Plans
*  4. General Layouts
*  5. General Elevations
*  6. Structural Drawings
*  7. Service Drawings
*  8. Other Specialist Drawings
*  9. Schedules
* 10. Component Drawings
* 11. Structural Calculations
* 12. Specifications
* 13. Bills of Quantities
* -------------------------
* Or
* IF You wish to start New Search, please type 'n'.
* IF You wish to go back to Selection Mode, please type 's'.
* IF You wish to End the Session, please type 'e'.
*
```

```
set demand option 'Enter Option'
*
*  **  Retrieval is being performed.  **
ex menu.plan
END PROCEDURE
PROCEDURE       MENU.PROG3:T
*
*
*
type tempfile
*
*
*    **  The list of schemes is being printed out.  **
*
*
*
*
*
*
*
*
*
*
*
ex menu.select
END PROCEDURE
PROCEDURE       MENU.PROG4:T
*
*
ex menu.main
*
END PROCEDURE
PROCEDURE       MENU.PROG5:T
*
*
*
*
*
*
*       B y e ,
*
*       See  You  Again !
*
*
*
*
*
END PROCEDURE
PROCEDURE       MENU.SELECT:T
*
ex menu.criteria
*     **  The Schemes of Your Interest are :
*
type tempfile
*
*  **  **  **  **  **  **  **  **  **  **  **  **
*
*  **  SELECTION  MODE  **
*
```

```
*  1. Details
*
*  2. Plans
*
*  3. Print
*
*  4. Begin New Search
*
*  5. End the Session
*
set demand option 'Enter Option'
ex menu.prog<option>
END PROCEDURE
```

```
END PROCEDURE
PROCEDURE       RET.RETPROG:T
retrieval
integer age, toc
compute tol=nread('Enter lower limit for Dwellings')
if(tol eq 7) stop
compute tou=nread('Enter upper limit for Dwellings')
compute sil=nread('Enter lower limit for Site Area in sq.m.')
compute siu=nread('Enter upper limit for Site Area in sq.m.')
compute lco=nread('Enter lower limit for Construction Costs in 1000 pounds')
compute uco=nread('Enter upper limit for Construction Costs in 1000 pounds')
compute co=nread('Enter Country Code')
compute rg=nread('Enter Region Code')
compute bdg=nread('Enter Code for Housing Form')
PROCESS CASES
.   PROCESS REC 1
compute age=(today(0)-conend)/365.25
IF(tol ne 00 and TOTDWEL LT tol) EXIT REC
if(tou ne 00 and totdwel gt tou) exit rec
.      IF(sil ne 00 and SITA LT sil) EXIT REC
if (siu ne 00 and sita gt siu) exit rec
if(age=0) compute toc=(tocost-sicost)/1
if(age=1) compute toc=(tocost-sicost)/1.05
if(age=2) compute toc=(tocost-sicost)/1.12
if(age=3) compute toc=(tocost-sicost)/1.2
if(age=4) compute toc=(tocost-sicost)/1.35
if(age=5) compute toc=(tocost-sicost)/1.41
if(age=6) compute toc=(tocost-sicost)/1.43
if(age=7) compute toc=(tocost-sicost)/1.52
```

```
if(age=8) compute toc=(tocost-sicost)/1.6
if(age=9) compute toc=(tocost-sicost)/1.75
.       IF(lco ne 00 and toc lt lco) exit rec
if(uco ne 00 and toc gt uco) exit rec
if(co ne 00 and cou ne co) exit rec
if(rg ne 00 and reg ne rg) exit rec
.        MOVE VARS IDNUM,NAMESCH
.       PROCESS REC 2
if(bdg ne 0 and bldg ne bdg) exit rec
.          PERFORM PROCS
.                       jump out
.       END PROCESS REC
out:
.    END PROCESS REC
END PROCESS CASES
WRITE RECORDS FILENAME=TEMPFILE/VARIABLES=IDNUM,NAMESCH/
     FORMAT=(I6,2X,A25)
END RETRIEVAL
END PROCEDURE
PROCEDURE      RET.TEST:T
retrieval
integer age, toc
compute country=nread('which country no')
PROCESS CASES
.   PROCESS REC 1
compute age=(today(0)-conend)/365.25
.   if(country ne 00 and cou ne country) exit rec
IF(REG NE <2>) exit rec
IF(TOTDWEL LT <3>) EXIT REC
if(totdwel gt <4>) exit rec
.       IF(SITA LT <5>) EXIT REC
if (sita gt <6>) exit rec
if(age=0) compute toc=(tocost-sicost)/1
if(age=1) compute toc=(tocost-sicost)/1.05
if(age=2) compute toc=(tocost-sicost)/1.12
if(age=3) compute toc=(tocost-sicost)/1.2
if(age=4) compute toc=(tocost-sicost)/1.35
if(age=5) compute toc=(tocost-sicost)/1.41
if(age=6) compute toc=(tocost-sicost)/1.43
if(age=7) compute toc=(tocost-sicost)/1.52
if(age=8) compute toc=(tocost-sicost)/1.6
if(age=9) compute toc=(tocost-sicost)/1.75
.       IF(toc lt <7>) exit rec
if(toc gt <8>) exit rec
.        MOVE VARS IDNUM,NAMESCH
.       PROCESS REC 2
if(bldg ne <9>) exit rec
.          PERFORM PROCS
.                       jump out
.       END PROCESS REC
out:
.    END PROCESS REC
END PROCESS CASES
WRITE RECORDS FILENAME=TEMPFILE/VARIABLES=IDNUM,NAMESCH/
     FORMAT=(I6,2X,A25)
END RETRIEVAL
END PROCEDURE
```

SUBROUTINES THAT GENERATE DETAILED DESCRIPTIONS OF HOUSING SCHEMES (EACH SUBROUTINE TREATS ONE OF 11 INFORMATION GROUPS (DET 1 TO 11) IN FIG. 6 OF CHAPTER 11].

```
C RET.DET1
RETRIEVAL
CASE IS 794060
PROCESS REC 1
compute rg=vallab(reg)
write '   '
WRITE NAMESCH ' at ' LOC
write 'in ' rg ' region'
WRITE 'Architect : ' namearch
write '   '
compute tconsta=datec (consta, 'mmm dd, yyyy')
compute tconend=datec (conend, 'mmm dd, yyyy')
compute mu=vallab(mud)
compute pu=vallab(puh)
compute pr=vallab(prh)
compute hf=vallab(hfs)
compute hr=vallab(hfr)
compute hs=vallab(hsr)
compute ho=vallab(hoa)
compute el=vallab(elh)
compute sp=vallab(sph)
compute rs=vallab(res)
compute mh=vallab(mhp)
compute ei=vallab(eia)
compute nt=vallab(ntd)
compute pd=vallab(pud)
compute rh=vallab(reh)
write '   '
WRITE  ' Construction started in ' tconsta ' and'
write  ' Construction completed in ' tconend
write '   '
write ' Is this scheme a Mixed Use Development ? : ' mu
write ' Is this scheme a Public Housing ? : ' pu
write ' Is this scheme a Private Housing ? : ' pr
write ' Is this scheme for Owner occupied  : ' hf
write ' Is this scheme for Rent ? : ' hr
write ' Is this scheme for both Sale & Rent ? : ' hs
write ' Is this a Housing Association scheme ? : ' ho
write ' Is this an Elderly Housing scheme ? : ' el
write ' Is this Single-person Housing ? : ' sp
write ' Is this a Resort or Second Home scheme ? : ' rs
write ' Is this a Mobile Home Park scheme ? : ' mh
write ' Is this Educational or Institutional Accommodation ? : ' ei
write ' Is this a New Town Development ? : ' nt
write ' Is this scheme part of a Planned Unit Development ? : ' pd
write ' Is this a Rehabilitation scheme ? : ' rh
write '   '
write ' Competition organised by, if any : ' compor
write ' Competition in ' compin
write '   '
write ' Design award from, if any : ' deaw
write ' Design award in ' dein
write '   '
end process rec
end case is
end retrieval
```

```
Orksoo Villa Heights        at 220-1 Orksoodong
in Sungdong               region
Architect : J.J.Engineering

Construction started in JUL 07, 1978  and
Construction completed in APR 14, 1979

Is this scheme a Mixed Use Development ? : Yes
Is this scheme a Public Housing ? :
Is this scheme a Private Housing ? : Yes
Is this scheme for Owner occupied  : Yes
Is this scheme for Rent ? :
Is this scheme for both Sale & Rent ? :
Is this a Housing Association scheme ? :
Is this an Elderly Housing scheme ? :
Is this Single-person Housing ? :
Is this a Resort or Second Home scheme ? :
Is this a Mobile Home Park scheme ? :
Is this Educational or Institutional Accommodation ? :
Is this a New Town Development ? :
Is this scheme part of a Planned Unit Development ? :
Is this a Rehabilitation scheme ? :

Competition organised by, if any : *
Competition in *

Design award from, if any : *
Design award in *
```

```
C RET.DET2
RETRIEVAL
INTEGER SPI, dwe, pre, puo, roa, anc, COV, RAT
string*9 rgu
string*11 ssi
CASE IS 794060
PROCESS REC 1
COMPUTE RGU=VALLAB(REGU)
COMPUTE SSI=VALLAB(SHSI)
COMPUTE SPI=(PERI/SITA)*100
compute dwe=(dwel/sita)*100
compute pre=(prex/sita)*100
compute puo=(puop/sita)*100
compute roa=(road/sita)*100
compute anc=(anci/sita)*100
COMPUTE ABC=DWEL+ANCI
COMPUTE COV=(ABC/SITA)*100
COMPUTE RAT=(TOTFLSP/SITA)*100
write '   '
WRITE NAMESCH ' at ' LOC
WRITE '   '
WRITE 'Its Site Area is ' SITA ' sq.m in ' RGU SSI 'shape :'
write 'Major Slope of Site runs ' orie ' at ' masl ' degree'
WRITE 'Perimeter Length is ' PERI ' metre.'
WRITE 'Thus its Site Perimeter Index is ' SPI ' %.'
write ' '
write 'Area covered by Dwelling is ' dwel ' sq.m'
write 'Area covered by Private External spaces is ' prex ' sq.m'
write 'Area covered by Public Open space is ' puop ' sq.m'
write 'Area covered by Roads is ' road ' sq.m'
write 'Area covered by Ancillary buildings is ' anci ' sq.m'
write '   '
WRITE 'Area covered by Buildings is ' ABC ' sq.m and '
WRITE 'Total Floor Spaces are ' TOTFLSP ' sq.m , thus its'
WRITE 'Plot Coverage is ' COV ' % and Plot Ratio is ' RAT ' %.'
write ' '
END PROCESS REC
END CASE IS
END RETRIEVAL
```

```
Orksoo Villa Heights       at 220-1 Orksoodong

Its Site Area is 55243  sq.m in irregular triangle     shape :
Major Slope of Site runs SSE  at 12  degree
Perimeter Length is 1433  metre.
Thus its Site Perimeter Index is 2  %.

Area covered by Dwelling is 7482  sq.m
Area covered by Private External spaces is 0  sq.m
Area covered by Public Open space is 32570  sq.m
Area covered by Roads is 14275  sq.m
Area covered by Ancillary buildings is 916  sq.m

Area covered by Buildings is 8398  sq.m and
Total Floor Spaces are 89884  sq.m , thus its
Plot Coverage is 15  % and Plot Ratio is 162  %.
```

```
C RET.DET3
RETRIEVAL
string*14 bdg, sp
string*16 ped
CASE IS 794060
WRITE '  '
PROCESS REC 2
WRITE  NOSEP ' Blocks in ' NOSTO ' Storeys '
END PROCESS REC
write '   '
process rec 4
compute bdg=vallab(bldg)
compute ped=vallab(pred)
compute tya=vallab(tyac)
compute sp=vallab(shpl)
compute bal=vallab(balco)
compute roo=vallab(roof)
write bdg '( ' ped ' ) :'
write 'Shape of Block Plan : ' sp
write 'Type of Access : ' tya
write 'Type of Balconies : ' bal
write 'Form of Roofs : ' roo
write '   '
end process rec
process rec 1
compute typa=vallab(typark)
compute tyga=vallab(tygar)
write 'Total Floor Space for Residential purpose is ' resflsp ' sq.m'
write 'Total Floor Space for All purpose is ' totflsp ' sq.m'
write '  '
write 'Its Parking provisions are ' extpark ' spaces in ' typa
write 'Garaging provisions are ' garpark ' spaces in ' tyga
write '   '
end process rec
END CASE is
END RETRIEVAL
```

```
1  Blocks in 11  Storeys
2  Blocks in 12  Storeys
4  Blocks in 13  Storeys
1  Blocks in 3  Storeys

flats          ( predominant type  ) :
Shape of Block Plan : rectangular
Type of Access : gallery: every fl.
Type of Balconies : recessed in a pair
Form of Roofs : flat

flats          ( secondary type    ) :
Shape of Block Plan : L shape
Type of Access : direct-pairs:ev.fl.
Type of Balconies : indiv. recessed
Form of Roofs : flat

Total Floor Space for Residential purpose is 80580  sq.m
Total Floor Space for All purpose is 89884  sq.m

Its Parking provisions are 182  spaces in com.on-str.along dw.
Garaging provisions are 0  spaces
```

```
C RET.DET4
retrieval
case is 794060
process rec 1
write namesch ' at ' loc ' :'
write '    '
write 'Total ' totdwel ' dwelling units and total ' totbed ' bedspaces'
write 'consisting  of ' nodifun ' different Unit types'
write '    '
end process rec
process rec 3
compute bdg=vallab(bldg)
compute cat=vallab(catsize)
write cat ' type for ' bdg
write     'unit size in sq.m is ' unitsize
write     'number of bedspaces is ' bedsp
write     'number of dwelling units of this type is ' nodwel
write '    '
end process rec
end case is
end retrieval
```

```
Orksoo Villa Heights       at 220-1 Orksoodong          :

Total 508  dwelling units and        2352  bedspaces
consisting  of 3  different Unit types

most freq'tly used    type for flats
unit size in sq.m is 122
number of bedspaces is 5
number of dwelling units of this type is 193

largest or 2nd lar't  type for flats
unit size in sq.m is 174
number of bedspaces is 6
number of dwelling units of this type is 52

smallest or 2nd sm't  type for flats
unit size in sq.m is 81
number of bedspaces is 3
number of dwelling units of this type is 108
```

```
C RET.DET5
RETRIEVAL
string*11 bdg
string*16 ped
CASE IS 794060
process rec 4
write '     '
write '< Structural type >'
compute bdg=vallab(bldg)
compute ped=vallab(pred)
compute fou=vallab(found)
compute str=vallab(struc)
compute flo=vallab(floor)
write '   '
write ped ' type for ' bdg ' :'
write '      foundation _ ' fou
write '      structure _  ' str
write '      floor     _  ' flo
write '   '
end process rec
process rec 4
compute bdg=vallab(bldg)
compute ped=vallab(pred)
compute hso=vallab(heatso)
compute hdi=vallab(heatdi)
compute air=vallab(aircon)
compute hem=vallab(heatem)
compute sol=vallab(solar)
write '< HVAC details >'
write ped ' type for ' bdg ' :'
write '    heating source  _ ' hso
write '    heat distribution method _ ' hdi
write '    air-conditioning system  _ ' air
write '    heat emitter     _ ' hem
write '    solar system     _ ' sol
write '   '
end process rec
PROCESS REC 5
compute bdg=vallab(bldg)
COMPUTE SOT=VALLAB(SPOT)
COMPUTE DMI=VALLAB(DOMI)
COMPUTE MTE=VALLAB(MATE)
COMPUTE FRM=VALLAB(FORM)
COMPUTE FNI=VALLAB(FINI)
COMPUTE PIN=VALLAB(PAIN)
WRITE '< Materials and finishes >'
write '* ' sot ' of ' bdg '( ' dmi') :'
write 'Material is ' mte ' ' frm
WRITE 'Finished in ' FNI ' , painted in ' PIN
END PROCESS REC
WRITE '   '
WRITE '   '
END CASE is
END RETRIEVAL
```

```
< Structural type >

predominant type  type for flats          :
     foundation _
     structure _  in-situ rein. conc.
     floor     _  in-situ slabs



secondary type    type for flats          :
     foundation _ raft: beam & slab
     structure _
     floor     _

< HVAC details >
predominant type  type for flats          :
    heating source  _ oil
    heat distribution method _ central plant
    air-conditioning system  _ all-wat:2 pipe
    heat emitter     _ rad. panel:low temp.
    solar system     _ none


secondary type    type for flats          :
    heating source  _
    heat distribution method _
    air-conditioning system  _
    heat emitter     _
    solar system     _

< Materials and finishes >
* external wall         of flats        ( predominant uses      ) :
Material is exposed structure      not applicable
Finished in naturally faced        , painted in emulsion paints

* roads                                 ( predominant uses      ) :
Material is bitumin substances     not applicable
Finished in naturally faced        , painted in none

* footways                              ( predominant uses      ) :
Material is conc                   slabs
Finished in naturally faced        , painted in none

* external wall         of ancillaries ( predominant uses      ) :
Material is ceramics               tiles
Finished in naturally faced        , painted in none
```

```
C RET.DET6
retrieval
integer age, sico, siwo, dico, ovco, toco
case is 794060
process rec 1
compute cend=datec (conend, 'mmm dd, yyyy')
write ' '
write namesch ' was built in ' cend
write ' '
write 'Its cost of Site Acquisition was ' sicost ' thousand Pounds'
write 'Its cost of Site Work was        ' siwoco '  thousand Pounds'
write 'Its Direct Cost was              ' dicost ' thousand Pounds'
write 'Its Overhead Cost was            ' ovcost '  thousand Pounds'
write ' '
write 'Its TOTAL Construction Costs was ' tocost ' thousand Pounds'
write ' ------------------------------- '
write ' '
write 'These may be equivalent to the following current'
write 'figures based on  the  National Price Adjustment'
write 'Formula  for  the  Construction Industry .'
write ' '
compute age=(today(0)-conend)/365.25
if (age eq 0)
compute sico=sicost*1
compute siwo=siwoco*1
compute dico=dicost*1
compute ovco=ovcost*1
compute toco=tocost*1
if (age eq 1)
compute sico=sicost*1.05
compute siwo=siwoco*1.05
compute dico=dicost*1.05
compute ovco=ovcost*1.05
compute toco=tocost*1.05
if (age eq 2)
compute sico=sicost*1.12
compute siwo=siwoco*1.12
compute dico=dicost*1.12
compute ovco=ovcost*1.12
compute toco=tocost*1.12
if (age=3)
compute sico=sicost*1.2
compute siwo=siwoco*1.2
compute dico=dicost*1.2
compute ovco=ovcost*1.2
compute toco=tocost*1.2
if (age=4)
compute sico=sicost*1.35
compute siwo=siwoco*1.35
compute dico=dicost*1.35
compute ovco=ovcost*1.35
compute toco=tocost*1.35
if (age=5)
compute sico=sicost*1.41
compute siwo=siwoco*1.41
compute dico=dicost*1.41
compute ovco=ovcost*1.41
compute toco=tocost*1.41
if (age=6)
compute sico=sicost*1.43
compute siwo=siwoco*1.43
compute dico=dicost*1.43
compute ovco=ovcost*1.43
compute toco=tocost*1.43
if (age=7)
compute siwo=siwoco*1.52
compute dico=dicost*1.52
compute ovco=ovcost*1.52
compute toco=tocost*1.52
if (age=8)
compute sico=sicost*1.6
compute siwo=siwoco*1.6
compute dico=dicost*1.6
compute ovco=ovcost*1.6
compute toco=tocost*1.6
if (age=9)
compute sico=sicost*1.75
compute siwo=siwoco*1.75
compute dico=dicost*1.75
compute ovco=ovcost*1.75
compute toco=tocost*1.75
write ' '
write 'Site Acquisition : ' sico ' thousand Pounds'
write 'Site Work        : ' siwo ' thousand Pounds'
write 'Direct Cost      : ' dico ' thousand Pounds'
write 'Overhead         : ' ovco ' thousand Pounds'
write ' '
write 'TOTAL Costs      : ' toco ' thousand Pounds'
write ' '
end process rec
end case is
end retrieval
```

```
Orksoo Villa Heights       was built in APR 14, 1979

Its cost of Site Acquisition was 3105   thousand Pounds
Its cost of Site Work was        210    thousand Pounds
Its Direct Cost was              7366   thousand Pounds
Its Overhead Cost was            863    thousand Pounds

Its TOTAL Construction Costs was 11544   thousand Pounds
 -------------------------------

These may be equivalent to the following current
figures based on  the  National Price Adjustment
Formula  for  the  Construction Industry .


Site Acquisition : 5433  thousand Pounds
Site Work        : 367  thousand Pounds
Direct Cost      : 12890  thousand Pounds
Overhead         : 1510  thousand Pounds

TOTAL Costs      : 20202  thousand Pounds
```

```
C RET.DET7
RETRIEVAL
CASE IS 794060
WRITE '   '
WRITE '< PUBLISHED COVERAGE >'
write '    '
process rec 6
compute prio=vallab(perio)
compute tdate=datec (dateis, 'mmm dd, yyyy')
ifthen (contex ne 121)
write ' Site Context              in ' prio 'published in ' tdate ':'
write '  "' arti '" , pp. ' incp
endif
ifthen (climat ne 121)
write ' Climatic Aspect           in ' prio 'published in ' tdate ':'
write '  "' arti '" , pp. ' incp
endif
IFthen (SIPLNG ne 121)
WRITE ' Site Planning Aspect     in ' PRIO 'published in ' tdate ':'
WRITE '  "' arti '" , pp. ' incp
endif
IFthen (BLDGFO ne 121)
WRITE ' Aspect of Building Form in ' PRIO 'published in ' tdate ':'
WRITE '  "' ARTI '" , pp. ' INCP
endif
ifthen (functi ne 121)
write ' Functional Aspect         in ' prio 'published in ' tdate ':'
write '  "' arti '" , pp. ' incp
endif
ifthen (physic ne 121)
write ' Physical Aspect           in ' prio 'published in ' tdate ':'
write '   "' arti '" , pp. ' incp
endif
ifthen (econom ne 121)
write ' Economical Aspect         in ' prip 'published in ' tdate ':'
write '  "' arti '" , pp. ' incp
endif
ifthen (techni ne 121)
write ' Technical Aspect          in ' prio 'published in ' tdate ':'
write '   ' arti ', pp. ' incp
endif
ifthen (social ne 121)
write ' Social Aspect             in ' prio 'published in ' tdate ':'
write '   ' arti ',' incp
endif
END PROCESS REC
WRITE '   '
write '  '
END CASE
END RETRIEVAL
```

```
< PUBLISHED COVERAGE >

 Economical Aspect        in Housing              published in DEC 15, 1980 :
  "Bldg Foundations & Cost Implication " ,      p75 to p79
 Technical Aspect         in Housing              published in DEC 15, 1980 :
  "Bldg Foundations & Cost Implication",      p75 to p79
```

```
C RET.DET8
RETRIEVAL
write '   '
WRITE '< FEEDBACK >'
case is 794060
PROCESS REC 7
compute asp=vallab(aspect)
write '  '
write 'Aspect : ' asp
write desc1
write desc2
WRITE '   '
end process rec
write '      '
END CASE is
END RETRIEVAL
```

```
< FEEDBACK >

Aspect : social
A block for foreigners. Social activities between foreign &
demestic residents rare. Bldg layouts  partly responsible.
```

```
C det9
retrieval
integer sidw sibe dwsi sire ansi sito
case is 794060
write '   '
write '* DENSITY  FIGURES *'
WRITE '   '
process rec 1
compute sidw=(totdwel/sita)*10000
compute sibe=(totbed/sita)*10000
compute padw=(extpark+garpark)/totdwel
compute dwsi=(dwel/sita)*100
compute sire=(resflsp/sita)*100
compute ansi=(dwel+anci)/sita*100
compute sito=(totflsp/sita)*100
write namesch ':'
write '   '
write 'Dwellings per hectare are          ' sidw
write 'Bedspaces per hectare are          ' sibe
write 'Parking spaces per dwelling are    ' padw
write 'Net plot coverage in % is          ' dwsi
write 'Net plot ratio in % is             ' sire
write 'Gross plot coverage in % is        ' ansi
write 'Gross plot ratio in % is           ' sito
write '   '
end process rec
end case is
end retrieval
```

```
* DENSITY  FIGURES *

Orksoo Villa Heights      :

Dwellings per hectare are          91
Bedspaces per hectare are          425
Parking spaces per dwelling are    .35827
Net plot coverage in % is          13
Net plot ratio in % is             145
Gross plot coverage in % is        15
Gross plot ratio in % is           162
```

```
C RET.DET10
retrieval
case is 794060
process rec 1
write '   '
write namesch ' at ' loc ' :'
end process rec
write '   '
process rec 8
write 'Area covered by Dwellings and Garaging : '
write '   '
write 'dwellings          ' dwst ' sq.m'
write 'private gardens    ' prga ' sq.m'
write 'garages            ' gara ' sq.m'
write 'aprons             ' apro ' sq.m'
write '   '
write 'Area covered by Roads, Parking & Footways :'
write '   '
write 'carriage ways      ' carr ' sq.m'
write 'external parking   ' capa ' sq.m'
write 'footways           ' foot ' sq.m'
write '   '
write 'Area covered by Public Open spaces : '
write '   '
write 'amenity open spaces ' amop ' sq.m'
write 'paths               ' path ' sq.m'
write 'infants playareas   ' chpl ' sq.m'
write 'sporting grounds    ' spgr ' sq.m'
write '   '
write 'Area covered by Ancillary buildings :'
write '   '
write 'shopping and business ' shbu ' sq.m'
write 'mechanical plants     ' mech ' sq.m'
write 'social and admin      ' soad ' sq.m'
write 'indoor sports facilities ' spfa ' sq.m'
write '   '
end process rec
end case is
end retrieval
```

```
Orksoo Villa Heights       at 220-1 Orksoodong          :

Area covered by Dwellings and Garaging :

dwellings          7482  sq.m
private gardens    0  sq.m
garages            0  sq.m
aprons             0  sq.m

Area covered by Roads, Parking & Footways :

carriage ways      9645  sq.m
external parking   2730  sq.m
footways           1900  sq.m

Area covered by Public Open spaces :
```

```
amenity open spaces 25600  sq.m
paths               6000   sq.m
infants playareas   950    sq.m
sporting grounds    0   sq.m

Area covered by Ancillary buildings :

shopping and business 0  sq.m
mechanical plants     0  sq.m
social and admin      0  sq.m
indoor sports facilities 0  sq.m
```

```
C RET.DET11
retrieval
string*7 par
string*11 fun
string*15 dom
string*17 mat, for
string*18 fin, pai
case is 794060
process rec 9
compute bld=vallab(bldg)
compute fun=vallab(func)
compute par=vallab(part)
compute dom=vallab(domi)
compute int=vallab(inte)
compute mat=vallab(mate)
compute for=vallab(form)
compute fin=vallab(fini)
compute pai=vallab(pain)
write '   '
write '* ' par'of ' fun'in ' bld
write '( 'dom') :'
write 'Its intermediate structure is ' int
write 'Its material is               ' mat for
write 'Its surface finish is         ' fin 'painted in ' pai
write '  '
end process rec
end case is
end retrieval
```

```
* ceiling of living room in flats
( predominant use ) :
Its intermediate structure is suspended ceiling
Its material is             plywood            flat sheets
Its surface finish is       decorative fabrics painted in none


* wall    of living room in flats
( predominant use ) :
Its intermediate structure is parti. masonry struc.
Its material is             solid timber       panels
Its surface finish is       naturally faced     painted in varnishes


* floor   of living room in flats
( predominant use ) :
Its intermediate structure is float cement screed
Its material is             solid timber       strips
Its surface finish is       naturally faced     painted in emulsion paints
```

4. EXAMPLES OF THE SUBROUTINES USED IN DATABASE RETRIEVAL AND THEIR INFORMATION OUTPUT

[* Give density figures of all terraced housing schemes contained in the system.]

```
PROCEDURE      DEMO.DENSITY:T
C density
retrieval
integer sidw sibe dwsi sire ansi sito
process cases
process rec 1
move vars namesch reg
compute sidw=(totdwel/sita)*10000
compute sibe=(totbed/sita)*10000
compute padw=(extpark+garpark)/totdwel
compute dwsi=(dwel/sita)*100
compute sire=(resflsp/sita)*100
compute ansi=(dwel+anci)/sita*100
compute sito=(totflsp/sita)*100
process rec 2
if (bldg ne 3) exit rec
perform procs
jump out
end process rec
out:
end process rec
end process cases
report filename=density/
  print=namesch('Scheme')  sidw('Dwellings/Ha')
       sibe('Bedspaces/Ha') padw('Parkings/Dwelling')
  dwsi('Net Plot Coverage in %')
  sire('Net Plot Ratio in %')
  ansi('Gross Plot Coverage in %')
  sito('Gross Plot Ratio in %')/
  nototals/
  sort=reg/
  heading=center('DENSITY FIGURES')/
end retrieval
END PROCEDURE
```

DENSITY FIGURES of Terraced Housing Schemes

Scheme	Dwellings/Ha	Bedspaces/Ha	Parkings/Dwelling	Net Plot Ratio in %	Gross Plot Coverage in %	Gross Plot Ratio in %
Chungyou Flower Town	39	198	1.00	97	39	97
Hyosung Villa VI	69	279	0.71	113	35	113
Hyundai Yuksam Terrace	56	265	0.72	86	29	86
Siheung Terrace Houses II	90	271	0.25	56	********	56
Yongsan Garrison Res'	22	77	********	40	********	41
Garden Residence	36	181	1.00	81	42	81
Hyundai Kwanyang Terrace	56	227	0.95	82	29	82
Halen Estate	29	92	1.24	********	********	********
Brittgarden Estate	********	********	1.30	********	********	********
Fullers Slade	18	47	********	********	********	********

[* A query for private housing schemes of between 400-500 dwelling units with gallery access to every floor.]

```
PROCEDURE      DEMO.TYAC1:T
C dummy1
RETRIEVAL
PROCESS CASES
PROCESS REC 1
if (puh ne 121) exit rec
IF (TOTDWEL LT 400 OR TOTDWEL GT 500) NEXT REC
move vars idnum namesch totdwel
process rec 4
if (vallab(pred) ne 'p' and tyac ne 2) exit rec
compute tya=vallab(tyac)
perform procs
jump out
end process rec
out:
end process rec
end process cases
WRITE records filename=tyac1/variables=idnum,namesch,totdwel,tya/
  format=(I6,3x,A25,2x,I6,4x,A18)/
END RETRIEVAL
END PROCEDURE
```

```
794070   Daemyung Apt               404    gallery: every fl
804030   Chungdam Taeyang Apt       403    gallery: every fl
824050   Younga Apt                 438    gallery: every fl
```

[* A query for schemes consisting of 12-storey blocks of which plan shape is not rectagular. Give their names, regions in which they are located, block plan shapes, numbers of separate building blocks and types of internal access.]

```
PROCEDURE       DEMO.SHPL:T
C shpl
retrieval
process cases
process rec 1
COMPUTE RG=VALLAB(REG)
move vars namesch
process rec 2
if (nosto ne 12) exit rec
compute bdg=vallab(bldg)
move vars  nosto nosep
process rec 4
if (vallab(pred) ne 'p' and shpl eq 3) exit rec
compute shp=vallab(shpl)
compute tya=vallab(tyac)
perform procs
jump out
end process rec
out:
end process rec
end process rec
end process cases
report filename=SHPL/
 print=namesch('SCHEME') rg('REGION') shp('PLAN SHAPE') nosto('STOREYS')
    nosep('SEP.BLOCKS') tya('TYPE ACCESS')/
end retrieval
END PROCEDURE
```

SCHEME	REGION	PLAN SHAPE	STOREYS	SEP.BLO-CKS	TYPE ACCESS
Daemyung Apt	Kangnam	I shape	12	3	gallery: every fl
Younga Apt	Kwanak	L shape	12	5	gallery: every fl
TOTAL				8	

[* A query for a description of predominant building materials used in living rooms of CT Apartment scheme. Give details in table form.]

```
C Table2
retrieval
case is 804030
process rec 9
move vars func part domi mate
perform procs
end process rec
end case is
table mate,func by part by domi/filename=table2/
end retrieval
```

MATE,FUNC BY PART BY DOMI

	living room					
	ceiling		wall		floor	
	predomina-nt uses	secondary uses	predomina-nt uses	secondary uses	predomina-nt uses	secondary uses
exposed structure...	0	0	0	0	0	0
bitumin substances..	0	0	0	0	0	0
chipping in bitumin.	0	0	0	0	0	0
conc................	0	0	0	0	0	0
GRC.................	0	0	0	0	0	0
cast stone..........	0	0	0	0	0	0
calcium silicate....	0	0	0	0	0	0
clay................	0	0	0	0	0	0
earth...............	0	0	0	0	0	0
ceramics............	0	0	0	0	0	0
asbestos............	0	0	0	0	0	0
cement..............	0	0	*** 1	0	0	0
solid timber........	0	0	0	0	*** 1	0
chipboards..........	0	0	0	0	0	0
plywood.............	0	0	0	0	0	0
cork................	0	0	0	0	0	0
natural slate.......	0	0	0	0	0	0
limestone...........	0	0	0	0	0	0
sandstone...........	0	0	0	0	0	0
marble..............	0	0	0	0	0	0
granites............	0	0	0	0	0	0
terrazzo............	0	0	0	0	0	0
aluminium...........	0	0	0	0	0	0
cast iron...........	0	0	0	0	0	0
wrought iron........	0	0	0	0	0	0
stainless steel.....	0	0	0	0	0	0
mild steel..........	0	0	0	0	0	0
copper..............	0	0	0	0	0	0
bronze..............	0	0	0	0	0	0
brass...............	0	0	0	0	0	0
zinc................	0	0	0	0	0	0
lead................	0	0	0	0	0	0
pvc coated steel....	0	0	0	0	0	0
plastic.............	0	0	0	0	0	0
linoleum............	0	0	0	0	0	0
rubber..............	0	0	0	0	0	0
glass...............	0	0	0	0	0	0
glass fibre.........	0	0	0	0	0	0
other...............	*** 1	0	0	0	0	0

[* A query for all public housing schemes located in KK province. Give their locations, names, site areas, and numbers of dwelling units. Give also their collective figures.]

```
PROCEDURE        DEMO.REPORT2:T
C Report of DEMO.report2
retrieval
process cases
process rec 1
if (prh ne 121) exit rec
move vars namesch reg sita totdwel
perform procs
end process rec
end process cases
report filename=report2/
 print=reg(L10) namesch('SCHEME') sita('SITE AREA')
  totdwel('DWELLING UNITS')/
  break=reg/
   heading=center('MULTI-FAMILY SCHEMES IN Kyungki Province')/
END RETRIEVAL
END PROCEDURE
```

MULTI-FAMILY SCHEMES IN Kyungki Province

REG	SCHEME	SITE AREA	DWELLING UNITS
Yongsan	Yongsan Garrison Res'	135060	300
S.Inchon c	Inchon Buknam Apt I	35012	420
E.Inchon c	Inchon Buknam Apt II	33610	400
N.Inchon c	Inchon Sinhyun	169167	1850
Kwangmyung	Chulsan V-2	81038	1380
	Chulsan V-1	65632	1080
	Chulsan I	39550	580
	Chulsan III	69150	599
	Chulsan II	123550	1484
	Chulsan II-1	36800	580
	Chulsan IV	34500	470
	Chulsan I-1	26130	500
		476350	6673
Tongduchon	Sangyun	20149	300
Puchon cit	Puchon Yakdae	108219	1040
Songtan ci	Songtan Suhjung Apt	43103	450
	Songtan Suhjung I	33698	382
		76801	832
Suwon city	Suwon Inkae	97585	830
	Kwunsun Scheme I	58949	758
	Kwunsun Scheme II	74975	930
		231509	2518
TOTAL		1285877	14333

[* A query for apartment schemes consisting only of 12-storey blocks with rectagular plan shape and internal gallery access to every floor.]

```
1.10    C demo.sample
1.20    retrieval
1.30    process cases
1.40    process rec 1
1.50    move vars namesch
1.60    process rec 2
1.70    if (bldg ne 4) exit rec
1.80    if (nosto ne 12) exit rec
1.90    compute bdg=vallab(bldg)
1.100   move vars nosto
1.110   process rec 4
1.120   if (vallab(pred) ne 'p' and shpl ne 3) exit rec
1.130   if (vallab(pred) ne 'p' and tyac ne 2) exit rec
1.140   compute shp=vallab(shpl)
1.150   compute tya=vallab(tyac)
1.160   jump out
1.170   end process rec
1.180   out:
1.190   end process rec
1.200   end process rec
1.210   end process cases
1.220   write namesch bdg nosto
1.230   write shp tya
1.240   end retrieval
```

```
Hyundai Kwanyang Terrace flats              12
rectangular          gallery: every fl
```

[* A query for schemes with triangular shaped sites.]

```
1.10    retrieval
1.20    process cases
1.30    process rec 1
1.40    if(shsi eq 1)
1.50    move vars idnum namesch shsi
1.60    end process rec
1.70    end process cases
1.80    write idnum namesch shsi
1.90    end retrieval
```

```
853233 Hyundai Kwanyang Terrace 4
```

[* Give the construction cost per sq.m. of schemes built in KN region during 1980 and 1984.]

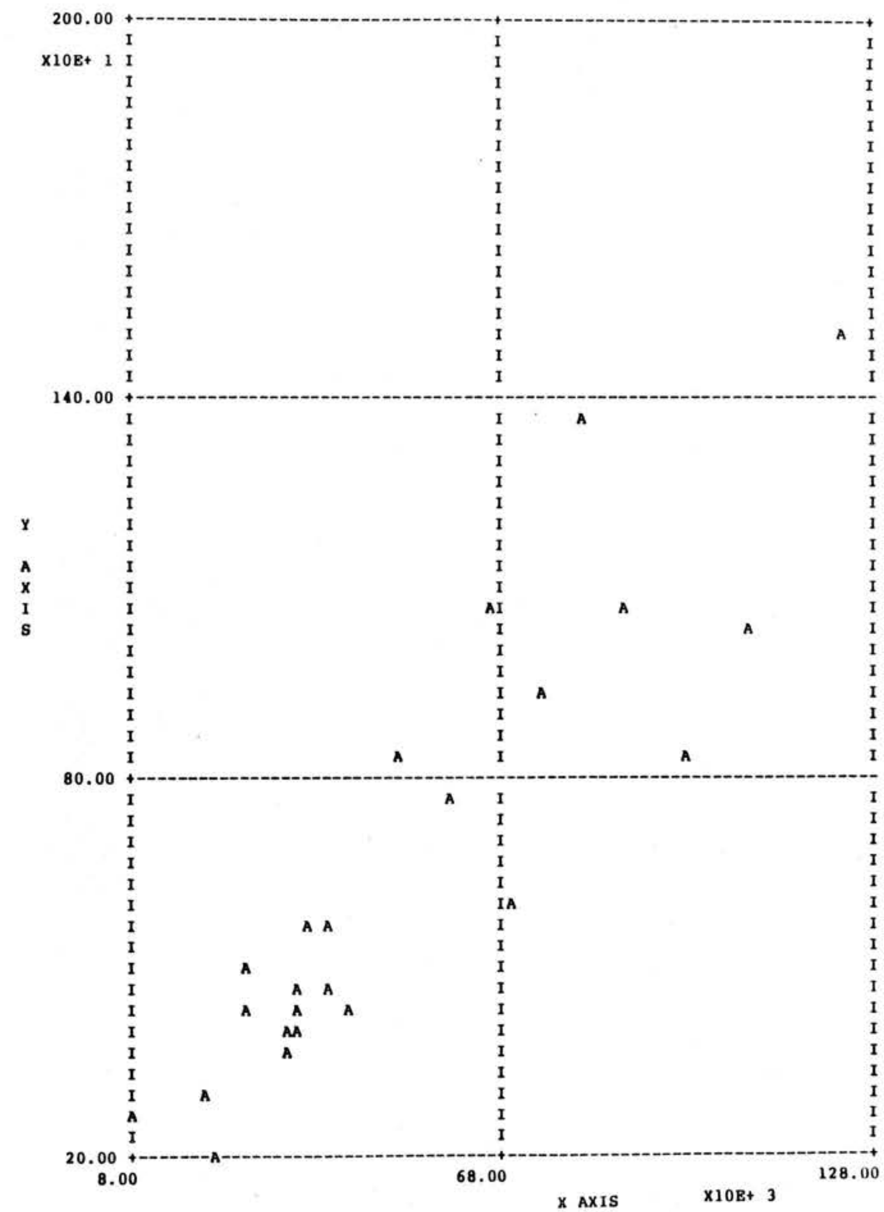
```
1.10    C Cost(DEMO.FF)
1.20    retrieval
1.30    integer coflr
1.40    write '*  Construction cost per sq.m of Schemes built'
1.50    write 'in Kangnam region during 1980 and 1984  *'
1.60    write '   '
1.70    write '   '
1.80    process cases
1.90    process rec 1
1.100   if (cou ne 14) exit rec
1.110   if (reg ne 1) exit rec
1.120   if (idnum lt 800000) exit rec
1.130   if (idnum gt 840000) exit rec
1.140   compute tcon=datec (conend, 'mmm dd, yyyy')
1.150   compute coflr=meanr((tocost/totflsp)*1000)
1.160   compute rg=vallab(reg)
1.170   move vars namesch
1.180   write idnum '   ' namesch
1.190   write 'built in ' tcon
1.200   write 'in ' rg ' built at ' coflr ' Pounds per Sq.M'
1.210   write '  '
1.220   end process rec
1.230   end process cases
1.240   end retrieval
```

```
*  Construction cost per sq.m of Schemes built
in Kangnam region during 1980 and 1984  *


804030    Chungdam Taeyang Apt
built in SEP 21, 1980
in Kangnam                 built at 151  Pounds per Sq.M

823001    Chungyou Flower Town
built in NOV 07, 1982
in Kangnam                 built at 410  Pounds per Sq.M

833010    Hyosung Villa VI
built in OCT 10, 1983
in Kangnam                 built at 354  Pounds per Sq.M

833222    Hyundai Yuksam Terrace
built in MAY 14, 1983
in Kangnam                 built at 353  Pounds per Sq.M

834150    Apkujung Misung Apt.
built in OCT 29, 1983
in Kangnam                 built at 334  Pounds per Sq.M
```

[* Plot the relations between site area and number of dwelling units of Korean pubic housing schemes contained in the system.]

```
1.10     C Plot2
1.20     retrieval
1.30     process cases
1.40     process rec 1
1.45     if (cou ne 14) exit rec
1.50     if (prh ne 121) exit rec
1.60     move vars sita totdwel
1.70     perform procs
1.80     end process rec
1.90     end process cases
1.100    plot scattergram=totdwel with sita/statistics=all/
1.110    end retrieval
```

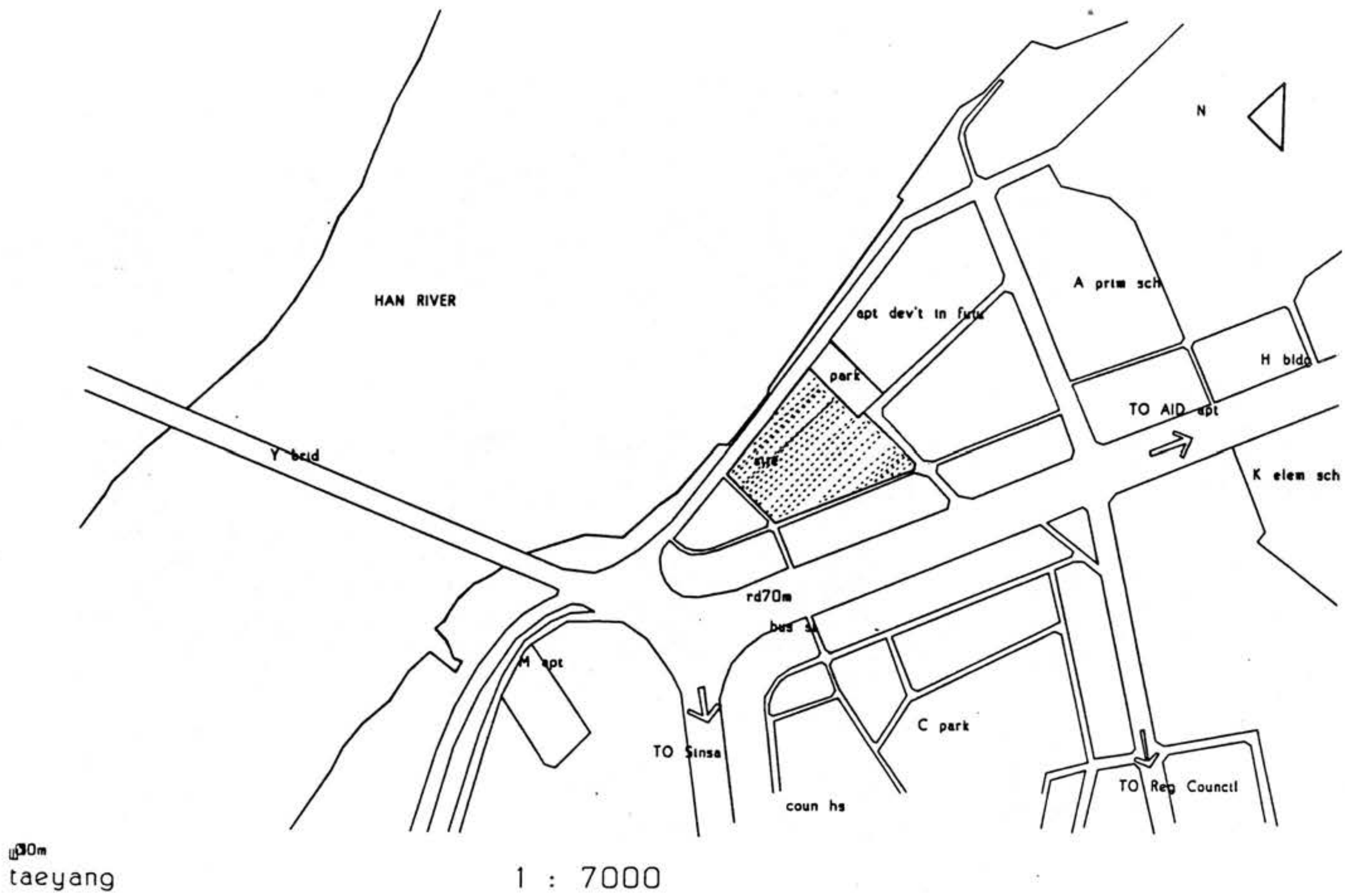
```
STATISTICS FOR     TOTDWEL   , number of total dwelling units
PLOTTED WITH       SITA      , total area of site in sq.m

THESE DATA POINTS ARE PLOTTED USING THE SYMBOL A


CORREL (R)                  .81099     R SQUARED                .65770
STAN ERROR ESTIM         270.38299     SIGNIFICANCE OF R        .00000
INTERCEPT A              194.14743     STAN ERROR A           93.38504
SIGNIFICANCE OF A           .02402     SLOPE OF B               .00849
STAN ERROR B                .00123     SIGNIFICANCE OF B       1.00000

VALID OBSERVATIONS    -        27.
MISSING OBSERVATIONS  -         2.
EXCLUDED OBSERVATIONS -         0.

--------------------------------------------------------------------------------
```



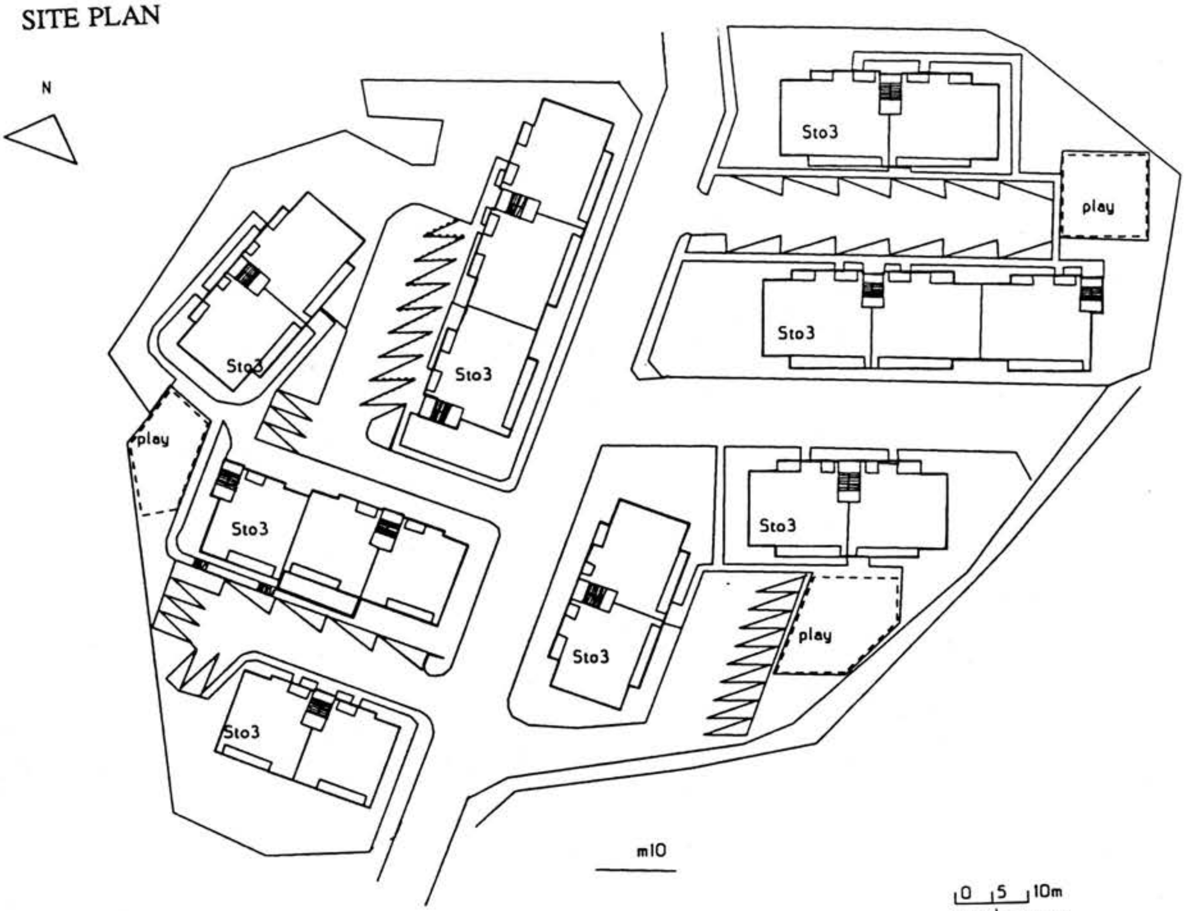
APPENDIX E. THE DEMONSTRATION SYSTEM

5. EXAMPLES OF DRAWINGS DISPLAYED ON A V.D.U. SCREEN

LOCATION MAP

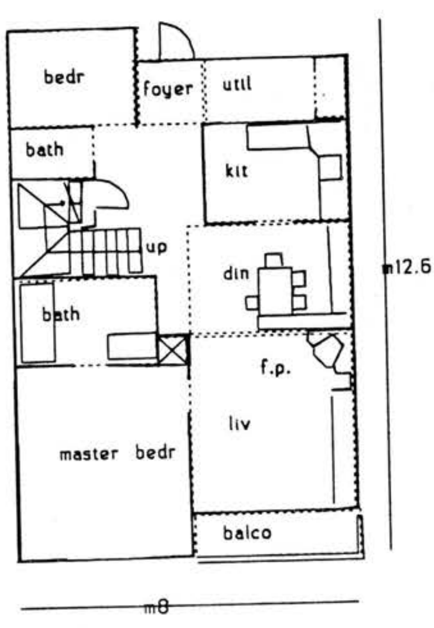


SITE PLAN

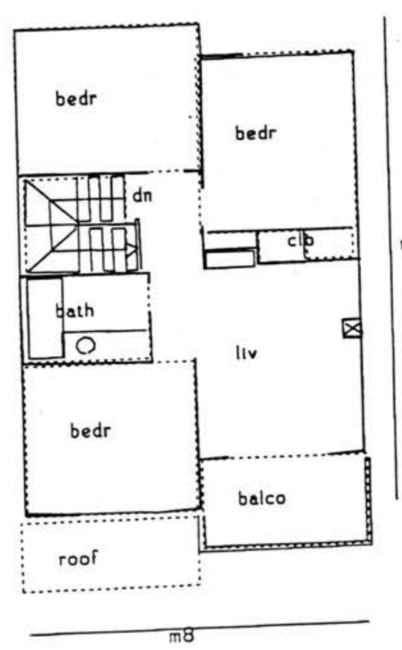


1 : 800

PLAN



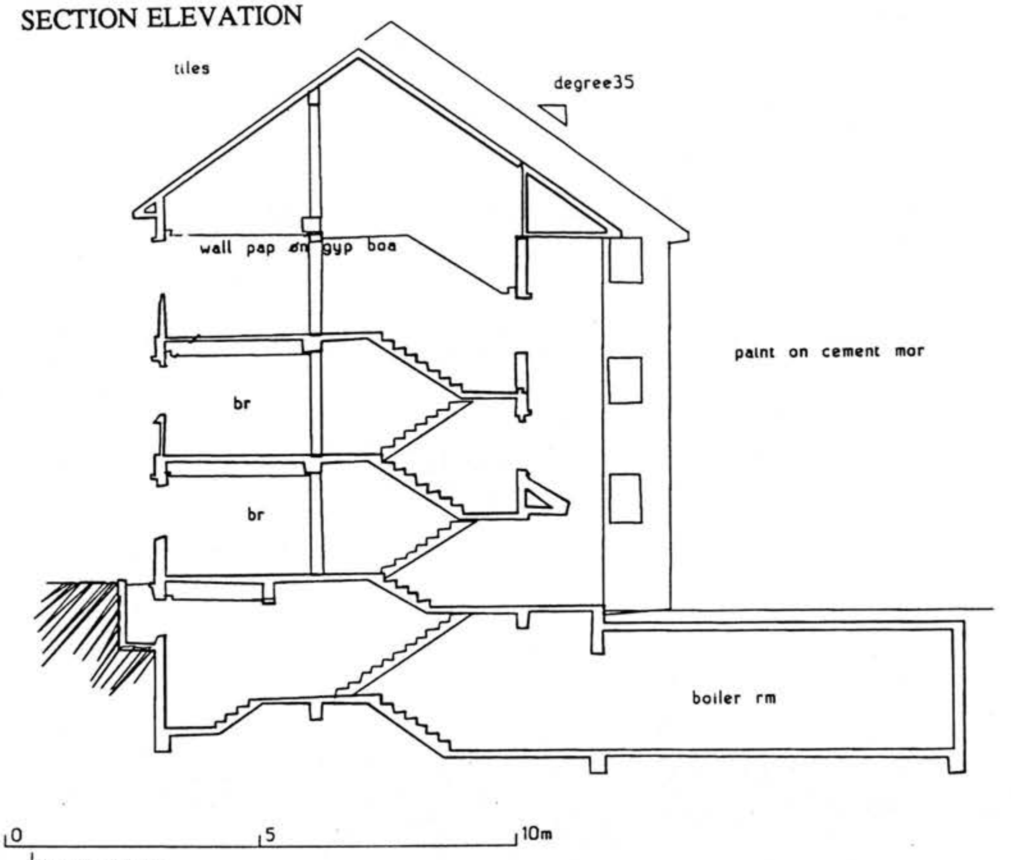
GROUND FL



FIRST FL

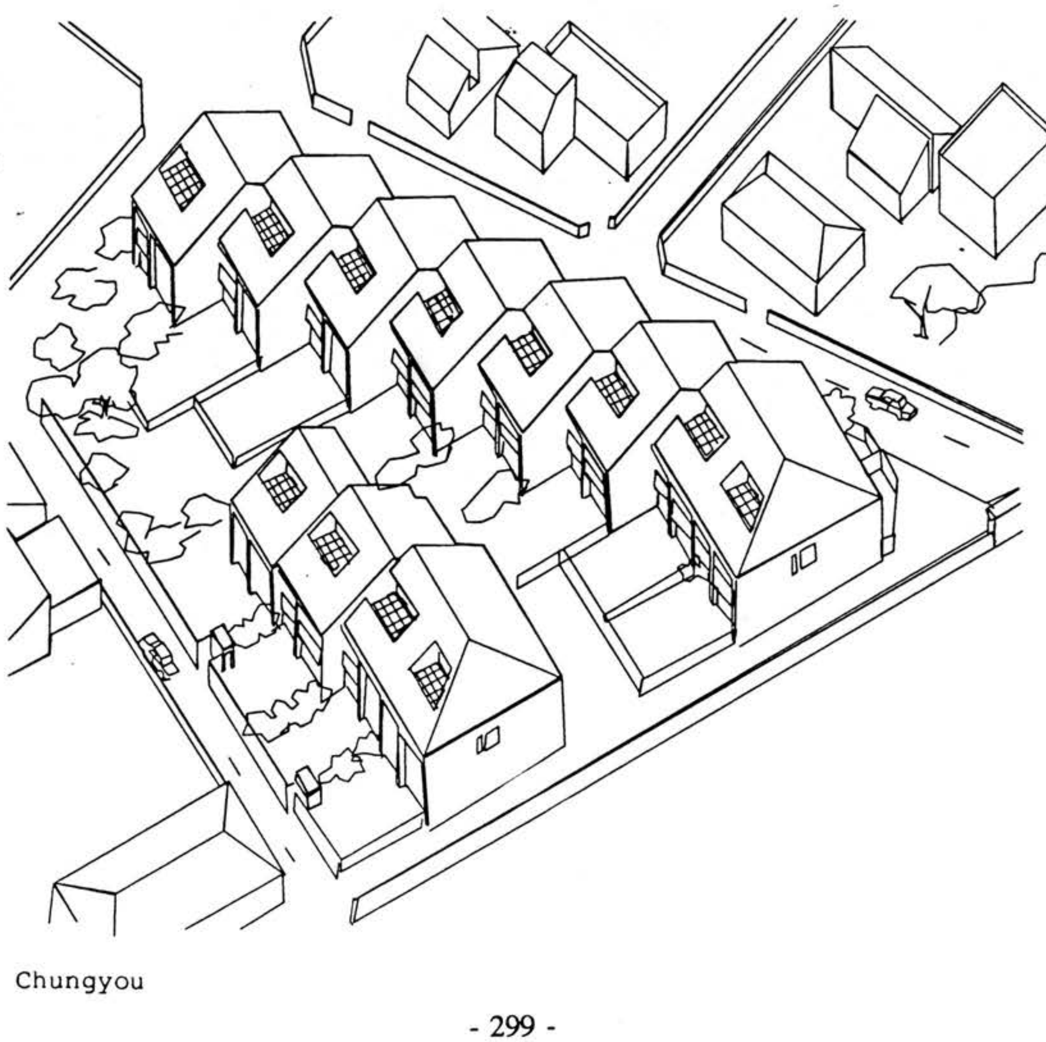
hyosung 1 : 160 0 5 10m

SECTION ELEVATION



hyosung

PERSPECTIVE



Chungyou

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